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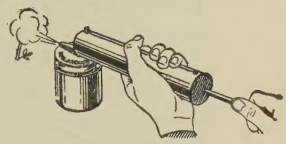

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KEMPER (H.). **Die Nahrungs- und Genussmittelschädlinge und ihre Bekämpfung.** [The Pests of stored Products for human Consumption and their Control.]—*Hyg. Zool.* **6,** ix+270 pp., 32 pls., 7 pp. refs. Leipzig, Paul Schöps, 1939. Price paper *M.* 15, cloth *M.* 17 (less 25% outside Germany).

This book is intended to provide persons in Germany concerned with foodstuffs and other stored products for human consumption, such as tobacco, with information regarding the bionomics and control of the chief pests that are likely to be found in them. Special emphasis is laid on the danger to human health that may result from the infestation of foodstuffs. The main section (pp. 20–175) deals with insects and mites and includes notes on the bionomics of each species or group, the injury caused and the appropriate methods of control. The question of control is discussed at greater length in the fourth chapter (pp. 192–219), in which it is emphasised that infestation of foodstuffs, etc., may be entirely avoided by correct methods of storage. The principal insecticides are reviewed, and some information on the control of pests by high and low temperatures is given.

ZACHER (F.). **Der gefleckte Pelzkäfer, *Attagenus pellio* L., ein wichtiger Webwarenschädling.** [*A. pellio*, an important Pest of Textiles.]—*Mitt. Ges. Vorratsschutz* **15** no. 3 pp. 29–31, 1 fig. Berlin, 1939.

Brief descriptions are given of the larva, pupa and adult of *Attagenus pellio*, L.; the egg is unknown. The adults of this Dermestid, which has one generation a year in Germany, appear to feed exclusively on pollen, and visit the blossoms of various plants, including hawthorn [*Crataegus*], sloe [*Prunus spinosa*], and *Spiraea*. They are also found on carcasses and in birds' nests. The larvae injure textiles and furs, and also feed on dead insects, flour, groats, casein, dried yolk of egg, smoked meat and smoked fish. They sometimes attack the bolting silk in flour mills. Females appear not to lay more than 50 eggs, and under unfavourable conditions development may be considerably protracted. Careful brushing and beating of fabrics, etc., usually suffices for control, but in severe infestations fumigation is sometimes necessary.

THIEM (H.). **Ueber das Verhalten des Kleinen Frostspanners (*Operophthera* (*Cheimatobia*) *brumata* L.) an Pfirsich.** [On the Behaviour of the Lesser Winter Moth on Peach.]—*NachrBl. dtsch. PflSchDienst* **19** no. 5 pp. 37–39, 2 figs., 13 refs. Berlin, 1939.

A statement by Dr. Hülsenberg that it is unnecessary to band peach trees against *Operophtera brumata*, L., led the author to examine the literature, in which he found records of peach among its food-plants and no statement that the larvae cannot live on peach leaves. He describes a series of laboratory experiments, which show that the larvae are unable to develop on peach. Those that hatch from eggs laid on it die after feeding on the young leaves. In mixed orchards, larvae blown from apple and cherry to peach also perish, and the injury done to the peach leaves is negligible. It is possible that amygdalin or some other substance in peach leaves is poisonous to the larvae.

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SPEYER (W.). **Die Wirkung von Dinitroorthocresolen auf Fische.** [The Action of Dinitro-ortho-cresols on Fish.]—*NachrBl. dtsch. PflSchDienst* **19** no. 5 pp. 43–44, 6 refs. Berlin, 1939.

In Germany, insecticides containing dinitro-ortho-cresol are being increasingly used instead of tar distillates. The latter are known to kill fish [*R.A.E.*, A **21** 172]. Tests of the action of two proprietary preparations containing dinitro-ortho-cresols showed them to be highly poisonous to sticklebacks, even at a dilution of 0·0003 per cent.

LEEFMANS (S.). **De draaihartigheid bij kool III.** [Deformed Heart of Cabbage III.]—*Meded. Tuinb.-Voorlichtingsdienst* no. 11, 52 pp., 4 pls., 2 fldg. graphs. The Hague, 1939.

Investigations on the bionomics and control of *Contarinia nasturtii*, Kieffer (*torquens*, de Meij.) causing deformed heart of cabbage and cauliflower in Holland [*R.A.E.*, A **26** 466] were continued in 1938, when a programme of work based on the experience of the two preceding years was carried out and further data were obtained.

The following is taken largely from the author's summary: Emergence cages [*loc. cit.*] proved fully effective for following the course of the flights, and the synchronisation in adult emergence over large areas [*cf.* **25** 640] that was noticed in 1937 was again observed in 1938. Growers in Holland can therefore be informed as to the correct dates for applying control measures, and this was satisfactorily effected in 1938 by wireless broadcasts. The chief reason for some unexpected injury was the sporadic distribution of infestation of the soil, but this can be overcome by applying control measures when cages in any part of the field show an emergence of 25 females per 100 sq. yds. The cages should be distributed on heavily infested land and the highest emergence figures taken as indicators.

Spraying headed cabbage [**26** 467] gave good results in the field when carried out at the right time, and was preferable to dusting. Injured plants generally recovered without special manuring or soil cultivation, and the application of the sprays can therefore be deferred until the adults become numerous. Three or four applications, at the rate of two per week, are required for headed cabbage and four or five for Lecerf cauliflowers planted after June. If this variety is planted in June, and is therefore present during the first two flights of the midge, still further applications are necessary. The most economical spray is 0·1 per cent. nicotine with either 1·5 per cent. soap, or 0·5 per cent. ammonia and 0·75 per cent. oleic acid. In years of severe injury, a more powerful insecticide should be used, the spray containing pyridine [**26** 467] being recommended. It should also be applied to those parts of a field that are liable to severe attack, such as the edges and other sheltered positions.

TRÄGÅRDH (I.). **Some Problems of modern Forest Entomology.**—*9th Congr. int. Un. For. Res. Insts 1936* repr. 12 pp. [Budapest, *n. d.*] [Recd. 1939.]

The two aspects of forest entomology dealt with are the economic possibilities of aeroplane dusting [*R.A.E.*, A **24** 109], which is shown to be amply justified by the value of the timber saved, and biological control, certain well-known examples of which are cited.

VUKASOVIĆ (P.). **Contribution à l'étude biologique de** *Galleria mellonella* **L.** [*In Serbian.*]—*Arh. Min. Pol'oprivr.* **6** no. 14 pp. 35–61, 1 graph, 4 figs., 11 refs. Belgrade, 1939. (With a Summary in French.).

A detailed account is given of laboratory investigations in Belgrade on the fertility of the wax moth, *Galleria mellonella*, L. The anatomy of the female genitalia, the development of the ovaries and the process of oviposition are described. Fertilised females deposited an average of 97·4 per cent. of the eggs contained in the ovaries, usually in large batches of at least a hundred and often of several hundred, the eggs being firmly glued together and to their support. Unfertilised females deposited a mean of only 22·6 per cent. of the eggs, and none hatched. They were deposited singly or in chains of up to 100 or more, and were not all attached to the support. Fertilised females lived for 7–10½ days and began to lay eggs 1 or 2 days after emergence. Dissections of 35 females of different ages and reared under different conditions showed that the average and maximum numbers of mature eggs in the ovaries were 676 and 1,392.

To determine the effects of larval nutrition on the fertility of the resulting females, batches of 35 larvae from eggs laid by the same female were reared under identical conditions of temperature and humidity on various natural diets having different wax contents. When the larvae were fed on an empty honeycomb that had harboured a brood of bees and contained 61·83 per cent. wax and 32·04 per cent. other organic substances, 32 gave rise to adults, the duration of development averaging 30 days. The period of emergence lasted 2 weeks and the number of mature eggs per female averaged 716. When the larvae were fed on the remains of an old honeycomb after part of the wax had been extracted by melting in hot water, so that it contained 48·26 per cent. wax and 40·43 per cent. other organic substances, 29 adults emerged. Development in one case lasted 30 days, but in the others it varied from 48 to 70 days, with a mean of 59 ; the average number of mature eggs per female was 762. In a test with a new honeycomb that had not been used for a brood and contained 96·89 per cent. wax and 2·11 per cent. other organic substances, only 10 adults emerged. Development was completed in from 47 to 92 days, and the average number of mature eggs per female was 346. Wax obtained from old combs by melting in hot water was an unsuitable breeding medium, as larval development was extremely protracted, and the larvae were undersized. Larval excreta alone proved to be a completely inadequate a diet.

CANDIOLI (P.). **Ulteriori ricerche sulla** *Cydia molesta* **e orientamenti della lotta dedotti dai risultati della sperimentazione.** [Further Investigations on *C. molesta* and the Orientation of Control deduced from the experimental Results.]—*Note Fruttic.* **17** no. 6 pp. 86–96, 2 diagrs., 2 refs. Pistoia, 1939.

Investigations on *Cydia molesta*, Busck, infesting peach in the region of Verona [*R.A.E.*, A **26** 594] were continued in 1938. The percentage infestation, as observed in comparable orchards in two localities, was very low. In one, the average annual percentage of infestation was 2·42 in orchards in which infested shoots had been removed twice weekly, and 8·26 in those in which this had not been done. In the other, the corresponding percentages were 2·26 and 12·91.

The injury was therefore reduced in these localities by 71 and 82·5 per cent., respectively, as the result of control. The low rate of infestation was due to various factors, including the removal of shoots, disinfestation of store rooms, etc., and control by indigenous parasites.

Infestation was not uniform in the territory examined, despite fairly uniform conditions, and the observations indicate a progressive decrease in the infestation of peach by *C. molesta*. In 1938, the measures taken resulted in a saving of peaches equal to 10 per cent. of the total crop, which is held to have justified the cost of control.

The experience gained during 5 years indicates that in unmixed peach orchards all late varieties ripening after 10th September should be eliminated, since they supply food and shelter for the larvae of the last generation ; all infested shoots should be removed twice weekly from May to September and immediately destroyed ; and all baskets, etc., that have been in contact with peaches should be disinfested.

In mixed orchards of peach and pear, in addition to the above measures, all baskets, etc., that have been in contact with pears should also be disinfested; winter pears should be carefully sprayed 2–4 times, beginning in early August, with an arsenical [*cf. loc. cit.*] ; and in new plantations, pear trees should be planted at a sufficient distance from peach to avoid contamination.

COSTANTINO (G.). **La tignola dell'uva o verme dell'uva** (*Polychrosis botrana* **Schiff.**). [The Vine Moth. *P. botrana.*]—*Boll. Osserv. Fitopat. Acireale* no. 72, 14 pp., 1 fig. Acireale, 1939.

This popular account of the morphology, bionomics and control of *Polychrosis botrana*, Schiff., has been compiled in view of complaints in Sicily during recent years of considerable injury to vines by this moth. It has three generations a year in Sicily. Its natural enemies are reviewed from the literature. The sprays recommended are lead arsenate against the larvae of the first and second generations and nicotine against those of the third.

CANZANELLI (A.). **L'Entomofauna dei nostri boschi. 1°. Le processionarie.** [The Insect Fauna of Italian Forests. 1. The Processionaries.]—*Riv. forest. ital.* **1** no. 4 pp. 253–258, 4 figs. Rome, 1939.

Thaumetopoea processionea, L., and *T. pityocampa*, Schiff., which infest oaks and pines, respectively, are very common in forests in North and Central Italy. All stages of both these Notodontids and the nests constructed by the larvae are briefly described. The adults of *T. processionea* occur in July, and the eggs from about mid-July to mid-August. The larvae hibernate, and pupate in their nests about 10th May. Females deposit about 200 eggs in small heaps on the smooth bark of young branches of old oaks or of the trunks of young ones. The adults of *T. pityocampa* occur in August and early September, and the eggs, which hibernate, hatch about 20th April. The larvae pupate in the soil in July. Females deposit 100–150 eggs in a spiral round 2 or 3 pine needles, forming a cylinder. The larvae of both species feed by night and frequently cause almost complete defoliation of the infested trees. Outbreaks, which may involve a whole forest, do not usually last more than two years, but there are always small centres of infestation. Larvae of both species can be

controlled by burning the nests, and in local infestations the foliage may be sprayed with arsenicals. Adhesive bands round the trunks of the trees will catch the larvae of *P. pityocampa* as they crawl down to the soil to pupate.

SIEBENMANN (—). **Ueber das Auftreten der Tannentrieblaus in den Stadtwaldungen von Zofingen.** [The Occurrence of *Chermes nordmannianae* in the Municipal Forests of Zofingen.]—*Schweiz. Z. Forstwes.* **90** no. 6 pp. 190–192. Bern, 1939.

Silver fir [*Abies*] is seriously threatened in the municipal forests of Zofingen, in the canton of Aargau, Switzerland, which cover about 3,600 acres at altitudes of 1,500–2,100 ft., owing to the great abundance of *Chermes nordmannianae*, Eckstein (*Dreyfusia nüsslini*, Börner) in the spring of 1939. In these forests, spruce, fir and beech are not generally intermingled, but predominate in individual stands, some of which consist almost entirely of silver firs varying from 10 to 40 years old. *C. nordmannianae* has been present in the area for about 25 years, but the small infestations that occurred were easily controlled. It increased considerably in the autumn of 1938, and as the individuals present between the end of August and the beginning of October have no wax coating [*cf. R.A.E.*, A **25** 727], a proprietary dust insecticide was applied experimentally to several trees; in the spring of 1939 these were found to be free from infestation. Other trees were sprayed in winter with a tar distillate or with an oil emulsion, also with good effect. In the spring of 1939, it was evident that an enormous increase of the Aphid had occurred in 1938, whole groups of trees being stag-headed and others so heavily infested that they appeared unlikely to survive. When the sap stream weakened, the Aphids moved down to the lower parts of the crown, and they left a tree when it died. As in these circumstances the use of an insecticide was impracticable, felling was resorted to; infested branches were burned, and young infested stems were singed. This operation was carried out during the oviposition period, which lasted from the end of April to mid-May, and some young forms were already present, so that the date was favourable for control. Close groups of silver firs up to about 22 ft. in height, which it was desired to preserve provisionally, were sprayed with 2 per cent. tar distillate.

Silver firs 100–120 years old have been infested for years without suffering much damage. In general, mixed stands have suffered less, especially those including deciduous trees, and so far, young silver firs under older trees have been attacked slightly or not at all. It is suggested that in future more oak and beech trees should be planted, so that stands become more mixed.

KOLUBAJIV (S.). **Příspěvek k biologii pilatek smrkových** *Lygaeonematus pini* **Retz.** (=*Nematus abietinus* **Christ**) **a** *Pachynematus montanus* **Zadd.** [A Contribution to the Biology of the Spruce Sawflies, *Pristiphora abietina*, Christ, and *Pachynematus montanus* Zadd.]—*Lesn. Práce* **18** pt. 6 pp. 317–338, 8 figs., 21 refs. Pisek, 1939. (With Summaries in German, French and English.)

The following is taken from the author's summary: Since 1935, there has been an increase in the population of *Pristiphora abietina*, Christ (*Lygaeonematus pini*, Retz.) on spruce in many districts in

Czechoslovakia [*cf. R.A.E.*, A **26** 657]. From sawfly cocoons collected in the autumn of 1935 and the spring of 1936 in a Moravian spruce forest, however, *Pachynematus montanus*, Zadd., emerged in greater numbers than *Pristiphora*, and it is suggested that it may be responsible for much of the injury attributed to the latter.

Parasites bred from cocoons of the two species comprised the Sarcophagid, *Agria affinis*, Fall. ; the Pteromalids, *Dibrachys* sp. and *Parapteromalus* sp. ; and the Ichneumonids, *Mesochorus petiolaris*, Brischke (possibly a hyperparasite), *Microcryptus brachypterus*, Grav. var. *aphyopterus*, Först., *M. galactinus*, Grav., *M. similis*, Haberm., *Polyblastus stenocentrus*, Hlmgr., *P. tener*, Haberm., *Erromenus simplex*, Thoms., *Stylocryptus brevis*, Grav., and *S. erythrogaster*, Grav. The last three were the commonest, *S. erythrogaster* being the most numerous of all. It was not possible to determine which of the sawflies was the host of these species ; most of them were not recorded in Nägeli's list of the parasites of *P. abietina* in Switzerland [**25** 212].

Forsslund (K. H.). *Lygaeonematus subarcticus* **Forssl.,** *L. pallidus* **Konow und** *L. stecki* **Nägeli.**—*Ent. Tidskr.* **60** no. 1–2 pp. 105–107, 1 fig. Stockholm, 1939.

The author has compared examples of *Pristiphora* (*Lygaeonematus*) *subarctica*, Forssl. [*cf. R.A.E.*, A **24** 346] and *P.* (*L.*) *stecki*, Nägeli [**25** 212] with the type of *P.* (*L.*) *pallida*, Konow. From various characters, principally those of the saw-like ovipositor, he concludes that *P. stecki* is a synonym of *P. pallida*, and that *P. subarctica* is distinct. The distribution of *P. subarctica* and *P. pallida* is briefly discussed.

Bovien (P.) & Bolwig (N.). *Dexia rustica* **Fabr. Oldenborrelarvens vigtigste Snylteflue.** [*D. rustica*, the most important Dipterous Parasite of Cockchafer Larvae.]—*Tidsskr. Planteavl* **43** pp. 801–818, 11 figs., 16 refs. Copenhagen, 1939. (With a Summary in English.)

Descriptions are given of the larva, puparium and adults of the Tachinid, *Dexia rustica*, F., which parasitises the larvae of *Melolontha* in Denmark. Examination of over 1,000 larvae of *M. melolontha*, L. (*vulgaris*, F.) taken in 1937 and 1938 showed that the percentage parasitism varied considerably from district to district. No larvae were parasitised in the year of hatching, and the highest percentages of parasitism generally occurred in larvae of the third and fourth years of development. The highest percentage was 53, in third-year larvae taken in one locality in November 1938.

Attempts were made to breed the Tachinid in the laboratory and in a hot-house, but no parasitism of *M. melolontha* was obtained. The preoviposition and oviposition periods lasted 2 weeks and 8 days, respectively, in females from parasitised hosts taken in the field. The eggs are deposited in the soil, and the larvae, which hatch immediately, burrow into it in search of suitable hosts. The development of the larvae within the hosts is briefly described. Parasitised hosts may be distinguished by the presence of one or more small apertures on the anterior parts of the thorax or abdomen, giving access to the spiracular funnels of the parasites. The largest number of larvae found in a single host was 17, but considerable mortality

usually occurs and only 1 or 2 larvae survive. They overwinter in the host. Pupation occurs in the soil, and the adults emerge during summer. Nematode larvae, probably a species of *Diplogaster*, were frequently observed in the spiracular funnels near the openings.

Hodson (W. E. H.) & Jary (S. G.). **A new Insect Pest of Chrysanthemum.**—*Agriculture* **46** no. 1 pp. 54–56, 2 pls. London, 1939.

A fly observed attacking chrysanthemums in nurseries in Middlesex and Kent and near Perth in 1938 was identified as *Paroxyna misella*, Lw., a Trypetid not previously recorded in Britain. Two types of injury were caused, namely, a terminal gall involving the tip of the stem and the surrounding leaves, and containing 1–8 larvae in one cavity, and a large mine in the leaf. Adults bred from the galls and mines appeared to be identical. The dates of infestation suggest that the fly has two, or possibly three, generations a year ; hibernation took place in the pupal stage. A wash of nicotine and soap gave some control of the leaf-mining larvae in June–July, and picking off the galls apparently eliminated one small infestation.

Maercks (H.). **Die Wiesenschnaken und ihre Bekämpfung.** [Tipulids and their Control.]—*Kranke Pflanze* **16** pt. 6 pp. 107–110. Dresden, 1939.

Considerable injury is caused in meadows, pastures and cereal fields in Germany, particularly in north-western districts, by Tipulids, the more important of which are *Nephrotoma* (*Pales*) *maculata*, Mg., *Tipula paludosa*, Mg., *T. czizeki*, de Jong, and *T. oleracea*, L. [*cf. R.A.E.*, A **25** 489, 728]. The numbers of eggs laid by females of *T. paludosa* from larvae reared on white clover or rye, and lettuce, were about 350 and 550, respectively, with a maximum of 1,300. Females of *T. oleracea*, which has two generations a year [*cf.* **25** 489], laid about 750, with a maximum of 1,300, and those of *N. maculata* about 100, with a maximum of 177. The eggs of *T. paludosa* are very sensitive to dryness, and mortality of those laid in moorland soil was least when the soil contained twice its dry weight of water. Dry weather in autumn kills eggs laid just below the surface of the ground. The larvae also required moisture for development, soil containing 3 times its dry weight of water being the optimum. They remain throughout the winter near the surface of the ground and migrate deeper only when the ground dries in spring. The young larvae prefer green leaves to roots ; in feeding experiments, larvae of *T. paludosa* and *T. oleracea* developed most rapidly and mortality was least on white clover. Cereal seedlings were much less suitable, and development was not completed on oats.

In years in which weather conditions are normal, injury by Tipulids can be prevented by cultural measures. In autumn, the surface of the ground should be well drained. During the flight period of *T. paludosa*, at the end of August and in September, the grass should be kept as short as possible, so that the adults are blown from it by wind. Manuring ensures a thick covering of grass, which hampers oviposition. If larvae of *T. paludosa* are present in grassland that is being ploughed up, oats should be sown rather than rye. A population of about 42 larvae per sq. yard causes serious injury in arable land, but grassland can support twice that number. In years of mass increase, several

times as many are usually present ; they can be controlled by strewing a poison bait consisting of 0·9 lb. Paris green or sodium fluosilicate and 22·5 lb. wheat bran per acre. The bait should not be applied in dry or frosty weather as then the larvae do not come to the surface to feed, and rainy weather is also unsuitable as the poison is washed from the bran. The bait should be scattered before injury has begun.

In laboratory experiments, calcium cyanamide applied to moorland soil in pots at a rate equivalent to 270 lb. per acre killed all the eggs and first-instar larvae and 50 per cent. of the second-instar larvae.

SCHUCH (K.). **Zur Hausbockkäferbekämpfung.** [Regarding the Control of *Hylotrupes bajulus*.]—*Holz als Roh- u. Werkst.* **2** pt. 6 pp. 235–238, 15 refs. Berlin, 1939.

Since the cost of applying control measures against *Hylotrupes bajulus*, L., which causes serious injury to timbers in attics in Germany, is relatively high, a preliminary investigation is in all cases desirable to ascertain whether living larvae are still present in the wood. If they are not, no measures are required, as the danger of reinfestation can practically be neglected. The liability of timber to infestation depends on its age ; little damage has been caused to timber over 50 years old, and hardly any infestations have been recorded in buildings over 180 years old. The nutritive quality of the wood is an important factor [*cf. R.A.E.*, A **27** 203, 204].

STEINER (P.). **Zur Prüfung des Bekämpfungswertes von Hausbockbekämpfungsmitteln.** [Regarding the Testing of Insecticides for Use against *Hylotrupes bajulus*, L.]—*Anz. Schädlingsk.* **15** pt. 5 pp. 49–51, 3 refs. Berlin, 1939.

The author criticises the technique of the experiments that led K. Schuch to the conclusion that the fumes of Xylamon are of little value for the control of *Hylotrupes bajulus*, L., in timber [*R.A.E.*, A **27** 202] on the ground that sound wood was used for the tests, whereas in practice infested timber is riddled with larval mines which facilitate penetration and become saturated with the fumes.

MÜLLER (H.). **Der Samenzünsler** *Paralispa* (*Aphomia*) *gularis* **Zeller und seine Bekämpfung.** [The Pyralid, *A. gularis*, and its Control.] —*Anz. Schädlingsk.* **15** pt. 5 pp. 51–56, 7 figs., 12 refs. Berlin, 1939.

Notes are given from the literature on the occurrence of *Aphomia* (*Paralispa*) *gularis*, Zell., in Germany [*cf. R.A.E.*, A **27** 355, etc.] and the larva and adults are briefly described. In February 1938, the crushed residue of soy beans from Manchuria in the store sheds of an oil mill in Hamburg was found to be infested by the larvae, which had also been observed on the bags of beans on board ship. In the sheds, there was only one generation a year ; the adults were present in June–July, and the resultant larvae fed from August to early October, when they spun cocoons for hibernation on the sacks, boards and beams. As they had not pupated by the end of April, 1939, pupation in unheated places probably occurs not long before adult emergence [*cf.* **25** 268]. *Dermestes lardarius*, L., which is often found in association with other pests and lives on waste matter, was observed in beams in the store shed. Females of *Microbracon hebetor*, Say, were seen attacking the larvae of *A. gularis*, but as this

Braconid was not bred from any of the larvae, it is assumed that the attack was occasional and that the females had developed on the meal moth [*Ephestia kuehniella*, Zell.] in the warehouse.

A proprietary pyrethrum mist spray was applied to the stacked bags of soy-bean residue in July and proved effective, causing the adults to abandon the crevices between the sacks and fall to the floor, where they died in 24–48 hours. The treatment was carried out at the peak of the flight period, and a few larvae appeared in autumn. It is therefore recommended that the spray be applied at the beginning of the flight. The pyrethrum spray also proved effective against *Ephestia elutella*, Hb., in a Hamburg warehouse containing raw cacao and dried bananas. Females of this moth that had come into contact with the spray did not oviposit before dying.

A mixture of lime and an adhesive was sprayed early in 1938 on to the beams and walls of the sheds and apparently imprisoned the adults of *A. gularis* that emerged beneath the coating. To prevent the spread of infestation, the bags were treated at the rate of 8,000 per day by exposure to a temperature of 80°C. [176°F.] for 4 hours.

In August 1938, larvae of *E. elutella* were observed on flax seed in a warehouse in which Chinese ground nuts had previously been stored. They were numerous in September and October and covered the seed with their webs.

Schulze (K.). **Neues Auftreten des Samenzünslers** *Paralispa* (*Aphomia*) *gularis* **Z.** [A new Occurrence of *A. gularis*.]—*Anz. Schädlingsk.* **15** pt. 5 pp. 58–59, 2 figs. Berlin, 1939.

From a sample of dried plums received from a warehouse in Hamburg, adults of *Aphomia* (*Paralispa*) *gularis*, Zell., emerged in January and February. The first young larvae of the next generation were observed early in March, at an average room temperature of 17–20°C. [62·6–68°F.]. In a sample of infested flax seed received at the same time, the first adults appeared in mid-March. These individuals were larger than those bred from the dried plums. The adults are described in some detail, and it is concluded that considerable variations occur.

Madel (W.). **Massenauftreten des kleinen Tabakkäfers in einer Berliner Wohnung.** [A Mass Occurrence of *Lasioderma serricorne* in a Dwelling in Berlin.]—*Anz. Schädlingsk.* **15** pt. 5 p. 59, 2 figs. Berlin, 1939.

Adults of *Lasioderma serricorne*, L., were observed in the summer of 1938 at the windows of a dwelling in Berlin into which two small linen bags containing beans in the pod from California had been brought three years before. The bags were stored in a cupboard in the dwelling, which had central heating. The beetles had fed on the dried seeds and pods and had eaten their way through the linen.

Geisthardt (G.). **Eine verkannte Schädigung durch den Walker in Forstkulturen.** [A misidentified Injury to young Forest Plantations by *Polyphylla fullo*.]—*Forstarchiv* **15** pt. 12 pp. 243–246, 3 figs. Hanover, 1939.

Recurrent injury, erroneously attributed to voles, occurred at Teupitz, Prussia, in four places in a plantation of pines on an area of

about 4½ acres, which had been clear felled in 1933 and replanted in 1934. In September 1938, however, it was found to be due to larvae of *Polyphylla fullo*, L., which gnawed the roots. Examination of the soil showed that the larvae were not numerous, but several were generally found near the roots of affected plants. Upwards of 28,000 1-year-old pine seedlings were planted in 1934, and replacements of 7,340, 3,000 and 400 became necessary in 1935, 1936 and 1937, respectively. After the death of the last lot, 200 birches and 200 American oaks were planted in the spring of 1938, but these were also attacked and hardly any survived the summer. Two smaller centres of infestation were found in which damage was caused to Douglas fir [*Pseudotsuga taxifolia*] planted in a neighbouring pine pole wood after clear felling in 1935. The measures advised are soil fumigation with carbon bisulphide, digging up the larvae, catching the adults, and strewing naphthalene or other repellents to prevent oviposition.

Schimitschek (E.). **Die Lebensweise des** *Dryocoetes minor*. [The Bionomics of *D. minor*.]—*Forstarchiv* **15** pt. 13–14 pp. 271–274, 6 figs., 3 refs. Hanover, 1939.

A list is given of the countries from which the Scolytid, *Dryocoetes minor*, Eggers, has been recorded. Eggers stated that in Sicily it occurred in oak bark, but in October 1938, the author found it common in a locality on the Black Sea coast of Anatolia in the trunks and branches of chestnuts [*Castanea sativa*] weakened by a fungous disease that causes the leaves from the top of the tree downwards to wilt and fall. On 31st October 1938, larvae and young beetles were present, and both hibernated. There are probably two generations a year. The maternal and larval galleries are described; both are formed mainly in the inner bark and do not enter the sapwood. The Braconid, *Dendrosoter protuberans*, Nees, parasitised the larvae and hibernated in the larval stage at the end of the mine in a cocoon, in which it pupated. It has two generations a year and in the region on the southern coast of the Black Sea in which *Picea orientalis* occurs, it also parasitises the larvae of *Ips sexdentatus*, Börner. Other hosts are given from the literature.

Klingstedt (H.). **Die Uvarovsche Theorie der Wanderheuschreckenphasen und ihre Bedeutung für die Zoologie.** [Uvarov's Theory of Phases in Migratory Locusts and its Importance in Zoology.]—*Notul. ent.* **19** pt. 1–2 pp. 1–16, 4 figs. 1 p. refs. Helsingfors, 1939.

A concise account is given of the theory of phase transformation in locusts [*cf. R.A.E.*, A **26** 677], and its possible importance in the study of dimorphism and migration in various animals is stressed. Cases of presumed phase differences in the structure of pronotum and elytra in several species of European Acridids are described.

Betrem (J. G.). **Takkensterfte, takkenboeboek en snoei in verband met productie bij koffie.** [Die-back, Twig-borers and Pruning in Relation to Crop Yield in Coffee.]—*Bergcultures* **12** no. 16 pp. 476–486. [Batavia] 1938.

The author has found that much of the mortality of coffee twigs ascribed to twig-boring beetles [*Xyleborus* spp.] in Java is due to other

factors affecting the health of the plants. *J. A. E.* **22** 312. The observations recorded in the present paper include some showing that the percentage of twigs infested by *Xyleborus* is greater and the average crop yield slightly though not significantly higher in bushes with one stem than in those with two stems.

Bakhuis (J. C.). **Kort verslag van een proef over bestrijding van *Helopeltis* in cacao door middel van verstuiven van derrispoeder.** A brief report of an Experiment in Combating *Helopeltis* on Cacao by Dusting with Derris. *Bergculturen* **12** no. 52 pp. 1790–1796. Batavia, 1938.

An account is given of an experiment carried out in Java in 1938 on the control of *Helopeltis antonii*, Sign., on cacao by means of a dust consisting of powdered derris (about 10 per cent. rotenone content) in 13 parts of talc and containing 0·72 per cent. rotenone. Applications were made on 11th and 21st April, 2nd May and 17th June. Counts of *H. antonii* were made immediately before and 2–3 days after each application and subsequently, and the numbers of bugs on treated trees expressed as percentages of those caught on untreated controls are shown in a table and in graphs. In the case of the nymphs, the numbers decreased on both treated and untreated trees, either because the dust extended to the untreated plots or as a result of the catching. There was, however, a considerable temporary reduction in the numbers of both nymphs and adults as compared with untreated trees. Thus, 9 days after the third application the number of nymphs on dusted trees was only 23 per cent. of that on the controls, but after 36 days (immediately before the fourth application), and again about 4 weeks later, the populations were about equal.

Paramasivan (C. J. H.). **De dierlijke beschadigingen van *Aleurites montana* Wils.** Injuries to *A. montana* by Pests. *Landbouw* **15** pp. 47–53, 4 refs. Buitenzorg, 1939.

Notes are given on the insects recorded from tung nut trees (*Aleurites montana*) in the course of 6 years' observations in western Java. Most of them are polyphagous. Those that caused injury included a Pterid of the genus *Mepanisa*, the larvae of which attack the germinating seeds; *Macrotermes gilvus*, Hag., and *Microtermes* sp., which feed on injured or dying roots; the weevils, *Dermatodes aeruginosus*, Guér., and *Myllocerus* sp., which cause serious defoliation; and the Eucerid *Mesosamanthus fractus*, Gerst., the adults of which feed on the flower buds, causing them to fall.

Cottrell (W.). **Citrus Pests: 5. Scale Insects. I. Shielded Scales.** — *N.Z.J. Agric.* **57** no. 5 pp. 429–432, 3 figs., 2 refs. Wellington, N.Z., 1938. **II. Unshielded Scales.** *Op. cit.* **58** no. 2 pp. 145–146, 3 figs. Wellington, N.Z., 1939.

The first part of this paper contains a generalised account of the life-history and morphology of shielded scales and notes on the morphology, taxonomy, distribution, food-plants and control of *Aonidiella aurantii* Mask. and *Chrysomphalus ross* Mask., which infest *Citrus* in New Zealand and are typical of this group.

In New Zealand, reproduction and development in *A. aurantii* continue on all the aerial parts of *Citrus* throughout the year, though more slowly in winter than in summer, and there appear to be three and sometimes four generations annually. It may be controlled by sprays of summer oil (1 : 33), which are best applied in February; two applications at a fortnight's interval are usually necessary [*cf. R.A.E.*, A **25** 80]. The trees should be well pruned to permit thorough penetration of the spray. The same oil at a lower concentration (1 : 40) should be used in February against *C. rossi*, which infests both surfaces of the leaves of *Citrus* and the fruits of orange, and adjacent hedges of *Elaeagnus*, which may serve as a source of infestation, should also be sprayed.

In the second part of the paper, the author deals in a similar way with unshielded scales, of which the two examples given are *Saissetia oleae*, Bern., and *S. coffeae*, Wlk., both of which also infest *Citrus* in New Zealand. Summer oil (1 : 60), applied in early summer as soon as the spring growth has hardened, is recommended for the control of both species. *S. oleae* apparently has one generation a year, and all stages are present during the winter. It infests the woody parts of the plants and exudes honey-dew, on which sooty mould grows. *S. coffeae* has probably more than one generation a year, and overwinters in the immature forms. It infests very young twigs, leaves and sometimes fruits, and is often not accompanied by sooty mould.

CLEARE (L. D.). **Report on the Entomological Division for the Year 1937.**—*Divl Reps. Dep. Agric. Brit. Guiana 1937* pp. 85–88. Georgetown, 1939.

Brief accounts are given of a survey in 1937 of the status of *Metagonistylum minense*, Tns., parasitising *Diatraea* on sugar-cane in British Guiana [*R.A.E.*, A **26** 491], and of an investigation of damage by *Xyleborus* [*badius*, Eichh.] to rum puncheons in transit to England [**27** 328]. Outbreaks of *Brassolis sophorae*, L., on coconut [*cf.* **26** 369] occurred in Georgetown and New Amsterdam during the year, and injury by *Colaspis hypochlora*, Lef., to fruits of bananas, and by *Solenopsis geminata*, F., to vegetable crops, is increasing.

WOKE (P. A.). **Inactivation of Pyrethrum after Ingestion by the Southern Armyworm and during Incubation with its Tissues.**—*J. agric. Res.* **58** no. 4 pp. 289–295, 15 refs. Washington, D.C., 1939.

The following is based on the author's summary: To determine whether the toxic principles of pyrethrum are inactivated after ingestion by larvae of *Xylomyges* (*Prodenia*) *eridania*, Cram., the larvae were fed on pyrethrum in turnip-leaf sandwiches, and later their tissues, gut contents and faeces were ground and tested against mosquito larvae for the presence of toxic principles. To ascertain the kind of tissues that might be responsible for such inactivation, pyrethrum was mixed with the various tissues and the gut contents from healthy larvae, incubated at 29°C. [84·2°F.] in the dark for 18 hours, and similarly tested against mosquito larvae. Half the material was agitated during incubation.

The results indicate that the toxic principles of pyrethrum may become inactivated, wholly or in high degree, after ingestion by

larvae of *Xylomyges*. The tissue of the digestive tract and the gut contents may reduce the toxicity of unextracted pyrethrum little or not at all, and of extracted pyrethrum only partly. The body fluid may have little or no effect. The skin and muscle tissues may greatly reduce the toxicity of agitated extracted pyrethrum, but only partly reduce that of unagitated extracted pyrethrum or unagitated or agitated unextracted pyrethrum. The fat-body may reduce the toxicity of unextracted pyrethrum partly and of extracted pyrethrum greatly, when these materials are not agitated, and very greatly reduce the toxicity of either when agitated.

Hatch (M. H.). **A bibliographical Catalogue of the injurious Arachnids and Insects of Washington.**—*Univ. Wash. Publ. Biol.* **1** no. 4 pp. 163–223. Seattle, Wash., 1938.

This is a catalogue in systematic order of Arthropods that are known to be injurious in the State of Washington, with references to the literature on their occurrence there. They comprise 641 species belonging to 18 orders. The references are stated to be of very unequal value and range from monographs and detailed technical studies to purely popular articles and those that merely mention the insect's occurrence. Indices to common names and to the orders, families and genera are appended.

Webster (R. L.). **Division of Entomology.**—*Bull. Wash. agric. Exp. Sta.* no. 368 (48th Rep. 1937–38) pp. 36–40. Pullman, Wash., 1938.

In tests of sprays against the codling moth [*Cydia pomonella*, L.] on apple in Washington, kerosene and a suitable soap, alone or with herring oil, proved an effective wetting and adhesive agent for lead arsenate. Stove oil was found to be a satisfactory substitute for kerosene in these mixtures. Seven cover sprays of a mixture of nicotine sulphate (1 : 800) with bentonite and herring oil gave effective control of *C. pomonella*, but were expensive and the residue of bentonite on the apples required a washing machine equipped with brushes for removal.

Tetranychus pacificus, McG., causes webbing of the foliage and fruits of apple, particularly in late August and early September, when large numbers of overwintering forms appear. These are characterised by the lack of green colour and the absence of males. Most of them hibernate near the bases of the trunks, in cracks or in litter on the soil, and in spring move up the trunks and attack the nearest foliage on the large branches. In 1938 most of the mites emerged from hibernation during April.

Three applications, at 10-day intervals, of a dust of cryolite (natural or synthetic), with an equal quantity of talc, gave almost complete control of *Heliothis armigera*, Hb. (*obsoleta*, F.) on tomatos. Two early applications at the same interval gave 96 per cent. control, and two, 22 days apart, 94 per cent. Calcium arsenate dust was less effective, and cryolite with maize meal still less so.

For the control of the onion thrips [*Thrips tabaci*, Lind.], which causes severe injury to greenhouse carnations in spring, derris or pyrethrum extract with spreaders, ground derris root with Karaya gum and a wetting agent, nicotine sulphate with molasses, and tartar emetic with spreaders were all more effective than tartar

emetic or Paris green with brown sugar [*cf. R.A.E.*, A **26** 489]. Fumigation with hydrocyanic acid gas is not generally possible, as plants susceptible to injury by it are usually grown with carnations. In greenhouses containing only carnations, fumigation in March with calcium cyanide at the rate of $\frac{3}{8}$ oz. per 1,000 cu. ft. controlled the thrips but injured tender growth. Lower dosages caused less damage but gave poor control, as also did a single fumigation with nicotine. Repeated treatment with nicotine is believed to affect the keeping quality of the flowers.

CHANDLER (S. C.). **The Peach Tree Borers of Illinois.**—*Circ. Ill. nat. Hist. Div.* no. 31, 36 pp., 22 figs., 2 refs. Urbana, Ill., 1939.

Aegeria (*Conopia*) *exitiosa*, Say, is the most injurious pest of peach in Illinois. The adults emerge from the last week of June to mid-October, maximum emergence occurring during the last week in August. They live about 6 days, and females lay 400–1,000 eggs, singly, on or round the base of the trunks of peach or related trees. The larvae hatch in 7–10 days, and enter the bark through cracks. Except during the winter they feed on the inner bark, usually just below ground level, and never more than 10 ins. below or above it. They pupate between mid-June and early September. The presence of the larvae in a tree cannot always be detected by surface examination, but gum and frass can usually be found at a depth of less than an inch in the soil.

The method of ringing trees with paradichlorobenzene crystals is described [*R.A.E.*, A **16** 455], the amounts recommended being $\frac{1}{4}$, $\frac{1}{4}$–$\frac{1}{2}$ and $\frac{3}{4}$ oz. for trees 1, 2 and 3–5 years old. The amounts used for older trees should be proportional to the thickness of the trunks; 1–1$\frac{1}{2}$ oz. suffices for most, but trees 12–20 years old having diameters of 12–17 ins. may require as much as 2 oz. Little injury was caused to the trees, except in the case of nursery stock, provided that the crystals did not touch the bark. The best control was given by treatment between 1st and 15th October in southern Illinois, between 20th September and 5th October in the centre, and between 15th September and 1st October in the north. Spring treatment, though less effective, gave good results in the south after the beginning of May. The removal of grass and weeds facilitates the spreading of the crystals, but does not increase control.

Other methods of treatment were tested in 1934–35 [**25** 32], and in 1937, paradichlorobenzene in emulsions of cottonseed oil, mineral oil, a mixture of equal parts of the two, and a miscible oil (Dendrol) either poured or sprayed round the base of the tree at the rate of 1, $\frac{3}{4}$ and $\frac{1}{4}$ oz. in $\frac{1}{2}$, $\frac{1}{2}$ and $\frac{1}{4}$ U.S. pints diluted emulsion containing 50 per cent. stock for trees 13, 5 and 2 years old, respectively, gave approximately the same control as equal weights of the crystals. Reducing the quantities of paradichlorobenzene in the cottonseed- and mineral-oil emulsions to $\frac{3}{4}$, $\frac{1}{2}$ and $\frac{1}{8}$ oz. on trees of the three ages, respectively, reduced the degree of control very little. Control was a little better when the carrier was cottonseed oil than when it was a mineral oil. The results given by emulsions of ethylene dichloride have already been noticed [**27** 255]; they were again used successfully in March 1938, when soil temperatures were low. Dichlorethyl ether (30 cc. per U.S. gal. water) was rather less effective at low temperatures and considerably so at higher ones.

Of peach trees examined in ten representative orchards of bearing age in southern Illinois, 22·6 per cent. were infested by *A.* (*Synanthedon*) *pictipes*, G. & R. This species is much less injurious than *A. exitiosa* as it works in crotches and wounds instead of girdling the base of of the tree. Painting the areas attacked by the larvae with a mixture of 2 lb. paradichlorobenzene per U.S. gal. Dendrol or Niagara tar oil diluted with water to half strength [**25** 33] gave 86·7 and 93·8 per cent. control, respectively, but tar oil is not recommended as it is likely to damage the trees. When the proportion of paradichlorobenzene in Dendrol was increased to 4 lb., all the larvae were killed, but the mixture was difficult to apply and liable to cause damage. Dichloropentane applied undiluted gave 70·8 per cent. control.

Phloeotribus (*Phthorophloeus*) *liminaris*, Harr., and *Scolytus rugulosus*, Ratz., generally attack weakened trees and branches and can usually be controlled by remedying the causes of the weakness. If they attack apparently healthy trees, an insecticide should be used. Paradichlorobenzene in Dendrol at the rate of 2 lb. per U.S. gal. diluted with water so that 1 U.S. pint contained 2 oz., gave good control of the adults of *S. rugulosus*, but not of the larvae. It should therefore be applied when the beetles first attack the trees, before they oviposit.

Osborn (H.). **Meadow and Pasture Insects.**—Med. 8vo, viii+288 pp., 103 figs. Columbus, Ohio, Educators' Press, 1939. Price $3·75.

This work covers a subject that has not been previously dealt with in comprehensive book form. It includes much original matter, as well as careful summaries of previous investigations, and should interest practically all entomologists and all owners of grazing land and livestock. Although it is written with reference to conditions in the United States, the ecological principles discussed and the control measures suggested are of general application. Four chapters on the ecological aspects of meadow and pasture fauna are followed by one on control measures; eight further chapters (pp. 70–272) deal with the different orders of insects. A list of the principal articles consulted (pp. 273–283), and an index conclude the work.

The ecological method of study is of particular importance for the control of pasture insects, since it is only occasionally that any one species appears in noticeably destructive abundance, whereas the aggregate annual loss caused by the combined attacks of many species is great. It is thus desirable to know the habits and possibilities of prevention or control of the composite or average annual assemblage. Moreover, the nature and value of the crop require methods that will apply to groups of pests and measures of low cost or the utilisation of ordinary farm practices. Hence, reliance is to be placed on rotation, burning, time of cutting or grazing and the use of poison baits that attract many different kinds of insects.

Graham (S. A.). **Principles of Forest Entomology.**—2nd edn., Med. 8vo, xvi+410 pp., 165 figs. New York & London, McGraw-Hill Publ. Co., Ltd., 1939. Price 24*s*.

The second edition of this work follows the plan of the first one [*R.A.E.*, A **17** 420] but contains an additional chapter on insects as transporters of other insects, and insects in their relation to wood-rot and stains, parasitic fungi and virus diseases. The earlier chapters have been brought up to date, especially as regards pests that have

recently become of economic importance in North America. Sections on insect abundance, termites, bark-beetles and losses caused by insects have been almost entirely rewritten. A brief statement as to where and by whom work on forest entomology is being conducted in the United States and Canada has been added to the chapter comprising a review of the history of the subject. Many new illustrations have been substituted for old ones, and others have been added to illustrate new data ; most of these have not been previously published.

Swain (R. B.). **Notes on the Biology of the Great Basin Tent Caterpillar, *Malacosoma fragilis* Stretch (Lep., Lasiocampidae).**—*Canad. Ent.* **71** no. 3 pp. 76–77. Guelph, 1939.

Notes are given on the bionomics of *Malacosoma fragilis*, Stretch, in Colorado, where it is often a serious pest of aspen [*Populus tremuloides*]. It feeds upon a wide variety of deciduous trees and shrubs and is the most abundant species of its genus in the Rocky Mountain region of the United States. In 1938 larvae were first observed in the field on 3rd April, and it is considered probable that this species serves as an early-season host for many parasites that later attack the fall webworm, *Hyphantria cunea*, Dru., which is the most abundant gregarious caterpillar of the Colorado eastern foothill region, but of which the larvae are not present until mid-June. From a small collection of half-grown larvae of *M. fragilis* in 1935, a single example of a primary parasite, *Rhogas* sp., was reared, whilst numerous adults of the genus *Tetrastichus* issued from cocoons probably made by *Rhogas*. *M. fragilis* has one generation a year, overwintering in the egg stage ; in the laboratory at room temperature development from hatching to adult emergence averaged 44 days ; development in the field, however, was more protracted.

Siegler (E. H.) & Goodhue (L. D.). **Effect of Particle Size of some Insecticides on their Toxicity to the Codling Moth Larva.**—*J. econ. Ent.* **32** no. 2 pp. 199–203, 1 fig., 4 refs. Menasha, Wis., 1939.

The following is from the authors' summary of this report of experiments on the effect of the particle size of five insecticides on their toxicity to larvae of *Cydia* (*Carpocapsa*) *pomonella*, L., when tested as sprays by the apple-plug method [*R.A.E.*, A **21** 338 ; **23** 174] : Three fractions each (fine, medium and coarse) of calcium arsenate, Paris green, synthetic cryolite and thiodiphenylamine (phenothiazine) and two fractions of acid lead arsenate were tested in replicated series. Except for thiodiphenylamine, there was no great difference in the toxicity of the different fractions, but the medium fraction was generally slightly superior. In the case of lead arsenate, the coarse fraction was somewhat more effective than the fine. The coarse fraction of thiodiphenylamine was much less toxic than the fine or medium fractions.

Felt (E. P.) & Bromley (S. W.). **The Hurricane and the newer Shade Tree Insect Problems.**—*J. econ. Ent.* **32** no. 2 pp. 203–205. Menasha, Wis., 1939.

The insect problems related to the loss of shade trees in the hurricane that occurred in the north-eastern United States in September 1938

are discussed. Repeated defoliation during previous years by leaf-eating insects and the consequent dying off of branches and invasion by wood-rot and cambium or bark borers are considered to be important factors contributing to the extensive destruction of shade trees in cities and villages. The weakening of trees or parts of trees by the storm has produced conditions favourable to the increase of borers, and attention is drawn to the importance of burning weak elm wood before 1st April to reduce the numbers of *Scolytus multistriatus*, Marsh., and of treating stumps, particularly elm stumps in areas where Dutch elm disease [*Ophiostoma ulmi*] is established.

GAMBRELL (F. L.) & HARTZELL (F. Z.). **Dormant Spray Mixtures on Conifers.**—*J. econ. Ent.* **32** no. 2 pp. 206–209, 7 refs. Menasha, Wis., 1939.

Results are given of experiments carried out in New York on the tolerance of conifers to various dormant and summer sprays and the toxicity of the materials to certain insects. In experiments previous to 1938, the injury done to spruce by oils applied against *Chermes* (*Adelges*) *abietis*, L. [*cf. R.A.E.*, A **23** 366] frequently varied during different seasons, even when the same dilution of a given mixture was used. Lime-sulphur at 1 : 8 did not injure spruce and was effective against this Aphid ; it was also used without injury on two kinds of juniper [*Juniperus*] against the juniper scale [*Diaspis visci*, Schr.]. In limited experiments, it was used on juniper in summer at 1 : 40 and 1 : 8 with no apparent injury. In 1936, foliage injury was severe on nursery trees of Koster blue spruce [a variety of *Picea pungens*] sprayed with Orthol-K oil (1 : 100) alone or in combination with lead arsenate, calcium arsenate or nicotine sulphate, and most of the trees sprayed on 11th June, the earliest date, were killed. Trees sprayed with calcium arsenate or lead arsenate at 4 lb. to 100 U.S. gals. either alone or in combination with nicotine sulphate (1 : 800) did not show any apparent foliage injury. Dormant applications on 4th May 1937 of 4 lb. lead arsenate in 100 U.S. gals. water with the addition of 1 U.S. qt. nicotine sulphate or 1 U.S. gal. Orthol-K oil or both caused no injury to the foliage of Norway spruce [*Picea abies*] and gave about 90 per cent. kill of *Recurvaria piceaella*, Kearf.

Dormant sprays of coal-tar oils at 1, 2, 3 and 4 per cent. actual oil did not cause noticeable injury to either buds or foliage of red and Scots pines [*Pinus resinosa* and *P. sylvestris*] and mixtures containing 2 per cent. or more gave 93–96 per cent. control of *Chionaspis pinifoliae*, Fitch. Lubricating-oil emulsions containing 2 and 4 per cent. actual oil injured the foliage and were less effective. Miscible oils gave varied results, but no serious injury was caused. Summer sprays containing 1 and 2 per cent. Orthol-K oil emulsion effected satisfactory control of the immature stages of *C. pinifoliae* without apparent injury to the trees. Dormant applications of DN-oil (oil containing 4 per cent. dinitro-ortho-cyclo-hexylphenol) at 2 and 4 per cent. concentrations afforded satisfactory control but were very toxic to the foliage ; at 1 per cent. they gave satisfactory control with much less injury. In tests of dormant sprays in 1938, red and Scots pines sprayed with 3 per cent. DN-oils or Elgetol (a salt of dinitro-cresol and other ingredients) against *C. pinifoliae*, were very seriously injured. Coal-tar oil at concentrations of 2 per cent. or more actual oil gave excellent control without causing foliage injury, and 1 per cent. DN-oil (4 per cent. DN)

gave satisfactory control in 1936 and 1937 with only slight injury. A 1 per cent. concentration of Elgetol caused serious injury but gave satisfactory control. Lime-sulphur (1 : 8) was safe and effective during 1938 for the control of *C. pinifoliae.*

In tests of toxicity of 6 treatments to 16 kinds of conifers in 1938, the spruces appeared to be the most sensitive, followed by Douglas fir [*Pseudotsuga taxifolia*], arbor-vitae [*Thuja*] and pine [*Pinus*]. It appeared that DN-oil (2 or 4 per cent. DN) and Elgetol at concentrations greater than 1 : 100 are likely to cause serious injury.

Anderson (L. D.) & Walker (H. G.). **Control of Whiteflies on Gardenias.**—*J. econ. Ent.* **32** no. 2 pp. 210–213. Menasha, Wis., 1939.

In February 1938, an infestation of Aleurodids on a tropical *Hibiscus* plant in a greenhouse in Virginia was completely controlled by dipping half the plant for 30 seconds in a solution containing 1 per cent. of a mixture of 60 per cent. Stantex Dispersing Oil (a mineral oil containing a small percentage of oleic acid and a spreader) and 40 per cent. of a derris extract in camphor sassafras base oil containing 5 gm. rotenone in 100 cc., 1 per cent. liquid Red " A " Soap (40 per cent. dry soap) and 98 per cent. water, and the other half for the same length of time in a 1 per cent. mixture of 80 per cent. Pyrolene M.P. (a sodium salt of a synthetic wax prepared from a vegetable base) and 20 per cent. of the derris extract. In view of these results, several tests were made with these and other recommended materials for the control of *Dialeurodes citri,* Ril. & How., which has been a serious pest of gardenias in eastern Virginia for some years. It is concluded from these tests that satisfactory control may be obtained by thorough spraying with 1 and 2 per cent. solutions of Stantex R (a mixture of 80 per cent. Stantex Dispersing Oil and 20 per cent. of the derris extract in camphor sassafras base oil) emulsified with soap, a 4 per cent. solution of Elgeté (an emulsified ground-nut oil) and 6⅔, 4 and 2 per cent. fish-oil emulsions, while 4 per cent. Ortho Brand Garden Volk (31·76 per cent. heavy grade petroleum oil, 2·07 per cent. nicotine alkaloid, 11·5 per cent. soap and 54·67 per cent. inert ingredients) and weaker solutions of Stantex R, Elgeté and fish oil did not give satisfactory control. Also, fish oil was disagreeable to handle, and injured foliage under certain conditions.

Walker (H. G.) & Anderson (L. D.). **Further Notes on the Control of the Harlequin Bug.**—*J. econ. Ent.* **32** no. 2 pp. 225–228, 4 refs. Menasha, Wis., 1939.

In tests carried out in Virginia to find a readily available and effective insecticide for use against *Murgantia histrionica,* Hahn, on cruciferous crops, good control was given by spraying thoroughly with a mixture of 4 lb. derris or cubé powder (rotenone content 5 or 6 per cent.) with 50 U.S. gals. water and a wetting agent, or with a mixture of 1 part Stantex R [see preceding abstract] emulsified in 50 parts water, or with a spray containing a concentrated derris extract and soap, which, however, is not readily obtainable. On large plants, two or three applications of spray at weekly intervals may be necessary.

LEONARD (M. D.). **Broadening the Field of Usefulness of Applied Entomology.**—*J. econ. Ent.* **32** no. 2 pp. 229–234. Menasha, Wis., 1939.

Economic entomologists have hitherto usually been associated with official organisations. The author points out that it is desirable that they should also be associated with various branches of industry and commerce, such as those concerned with the production and sale of insecticides, warehousing, canned and frozen foods, the control of household pests, and aeroplane dusting. Private practice as a consulting entomologist is also suggested.

GLASGOW (H.). **The Element of Timing in Relation to Pea Aphid Control.**—*J. econ. Ent.* **32** no. 2 pp. 234–240, 2 figs. Menasha, Wis., 1939.

As the result of studies on the control of the pea aphis [*Macrosiphum onobrychis*, Boy.] in New York, a method of estimating populations in the field was adopted consisting of a field collection with the aid of a standard beating net, repeated at intervals throughout the season, and counts of representative groups, from which the total number taken was computed. Such records enable those directing control to know the degree of infestation in each field of the territory for which they are responsible, and to detect and correct mistakes or failures that may have occurred in the course of field operations. They also make possible the avoidance of unnecessary treatment and, to a certain extent, the forecasting of the course of infestation according to prevailing weather conditions.

In addition, supplementary field experiments, one example of which is described, may be carried out to aid in determining the best time to begin control operations, the number of applications to make and the results to be expected from deferred applications made after the optimum period for treating has passed.

CHIU (Shin Foon). **Toxicity Studies of so-called "Inert" Materials with the Bean Weevil, *Acanthoscelides obtectus* (Say).**—*J. econ. Ent.* **32** no. 2 pp. 240–248, 4 figs., 16 refs. Menasha, Wis., 1939.

Laboratory experiments having shown that certain so-called "inert" materials, when used as dusts, were definitely toxic to a number of insects infesting stored products, a study was made of the toxicity of 6 chemically inert dusts to *Bruchus* (*Acanthoscelides*) *obtectus*, Say, and their physiological action upon it. The methods used in the tests are described; the dusts were applied directly to the beetles. Abbott's formula [*R.A.E.*, A **13** 331] was used for deducting the mortality attributable to natural causes, and time-mortality curves were plotted according to the method of Bliss [**26** 165]. The most effective material was bentonite, followed by magnesium carbonate, crystalline silica, amorphous silica, talc and walnut-shell flour. The last-named had no insecticidal value; the others gave 100 per cent. mortality in from 2 to 17 days. There was a definite correlation between toxicity and the particle size of the materials, those with the finest particles being the most toxic. There was practically no toxic effect with particles over 100 microns in diameter. Insects dusted with effective materials

lost weight very rapidly. This was assumed to be due mainly to loss of water. The oxygen consumption of dusted Bruchids was normal. It is thought, therefore, that these materials kill by desiccation.

Guy (H. G.) & Dietz (H. F.). **Further Investigations with Japanese Beetle Repellents.**—*J. econ. Ent.* **32** no. 2 pp. 248–252, 5 refs. Menasha, Wis., 1939.

In laboratory experiments, undertaken during 1938 to correct unfavourable physical properties in tetra-methyl thiuram bisulphide used as a repellent against the Japanese beetle [*Popillia japonica*, Newm.] [*cf. R.A.E.*, A **24** 546; **25** 424, etc.], the most suitable mixture tested on bean and smartweed was one of 80 per cent. tetra-methyl thiuram bisulphide, 14 per cent. clay, 5 per cent. bentonite and 1 per cent. Lorol alcohol. Of several adhesives tested, only zinc sulphate and hydrated lime (1 lb. each per 100 U.S. gals.) increased the efficiency of the mixture. Mixtures of tetra-methyl thiuram bisulphide were found to be compatible with derris, lead arsenate, hydrated lime, thiodiphenylamine (phenothiazine) and wettable sulphur, but not with Bordeaux mixture. Orchard experiments on apple and peach trees in Delaware confirmed the results of laboratory studies. Replacing part of the clay with bentonite improved retention and therefore protection. The most effective concentration of the mixture tested was 5 lb. per 100 U.S. gals., but $2\frac{1}{2}$ lb. gave better protection than the recommended mixture of 4 lb. derris plus 4 lb. resin residue emulsion.

Pierpont (R. L.). **Japanese Beetle Control Tests on American Elm Trees in Delaware.**—*J. econ. Ent.* **32** no. 2 pp. 253–255, 4 refs. Menasha, Wis., 1939.

In tests in Delaware of the comparative efficiency of 4 substances in combination with various adhesives to protect the foliage of American elms [*Ulmus americana*] against *Popillia japonica*, Newm. [*cf. R.A.E.*, A **24** 773; **25** 424; **26** 551], the best results were given by 4 lb. ground derris with 2 or 4 U.S. pints resin residue emulsion [**24** 727] per 100 U.S. gals., and 5 lb. tetra-methyl thiuram bisulphide (20 per cent. inert ingredients [see preceding abstract]) with 1 U.S. pint resin residue emulsion per 100 U.S. gals. These gave better protection than 20 lb. hydrated lime with 1 U.S. pint resin residue emulsion or with 3 lb. aluminium sulphate per 100 U.S. gals. and practically as good protection as lead arsenate, which, unlike the other materials, caused severe foliage injury.

Langford (G. S.), Crosthwait (S. L.) & Whittington (F. B.). **A Review of Cooperative Japanese Beetle Retardation Work in Maryland.**—*J. econ. Ent.* **32** no. 2 pp. 255–259. Menasha, Wis., 1939.

The lines on which control of *Popillia japonica*, Newm., was organised before 1938 in Maryland, where the beetle first appeared in 1926, are briefly outlined, and the retardation programme inaugurated in co-operation with the U.S. Bureau of Entomology in 1938 is described. In all infested areas where it was possible, trapping, spraying, soil treatment, establishment of parasites, agricultural adjustment and education were practised, and each of these activities is dealt with.

About 40,000 traps were operated during the year, and 123,166 U.S. qts. beetles were caught. Two applications of a spray of aluminium sulphate and lime reduced the numbers of beetles in the neighbourhood of loading platforms by 80 per cent. A list is given showing the order of effectiveness of 7 sprays, the protective value of which to apple and shade trees was tested. Dusting with hydrated lime reduces infestation considerably, but has to be repeated after rain. Treatment of lawns against the larvae with 10 lb. lead arsenate per 1,000 sq. ft. is effective for a period of 5 years. From 2 to 3 months after the application of colloidal lead arsenate at 0·66 lb. as recommended by the manufacturers and standard lead arsenate at 10 lb. per 1,000 sq. ft., as recommended by the government, the average numbers of living larvae per sq. ft. were 12·26 and 1·26, respectively, and in the untreated control, 12·6. During the year, 300 colonies of *Tiphia vernalis*, Rohw., and 64 of *T. popilliavora*, Rohw., were liberated in the State. The results are given of tests made to determine the most suitable varieties of maize to grow and the best dates for planting when infestation is severe.

HAMMER (O. H.). **The Tarnished Plant Bug as an Apple Pest.**—*J. econ. Ent.* **32** no. 2 pp. 259–264, 4 figs., 3 refs. Menasha, Wis., 1939.

Injury that has been noted on apples throughout the fruit-growing districts of eastern New York during the past few years, and which increased considerably in 1936 and 1937, was found during 1938 to be caused by the feeding and oviposition punctures of *Lygus pratensis*, L. The feeding punctures usually result in small surface scars, sometimes surrounded by slight depressions, and the oviposition punctures result in conspicuous elliptical external depressions showing very little russetting and extending internally to the core of the fruit or to the fibrovascular bundles, which appear to be pulled outward at the point of injury. The depth of the depression varies with the variety of apple. For purposes of comparison, figures are given of the external and internal injury caused by *L. pratensis*, *Lygidea mendax*, Reut., *Tachypterellus quadrigibbus*, Say, and *Callimome druparum*, Boh. There was very little blasting of buds. In 1938, overwintered adults began feeding on apple buds soon after the delayed-dormant stage and were most abundant during the pink-bud and blossom periods. Oviposition occurred in the fruit buds as soon as the stems began to separate in the clusters and continued in the fruits until they were about ½ in. in diameter. Migration to weeds and herbaceous plants then took place. The degree of injury is affected by weather, and by the proximity of the trees to suitable hibernation quarters. Preliminary control tests are briefly described, and a table is given showing the results, which were, however, inconclusive.

HOUGH (W. S.). **Dinitro-O-Cresol, Dinitro-O-Cyclo-Hexylphenol and Lauryl Rhodanate in Dormant Sprays against Eggs of Apple Aphids.**—*J. econ. Ent.* **32** no. 2 pp. 264–270, 8 refs. Menasha, Wis., 1939.

The following is mainly taken from the author's summary of this account of orchard experiments carried out in Virginia in 1927 and 1938: Dinitro-ortho-cresol, its soluble salt, sodium dinitro-ortho-cresylate, dinitro-ortho-cyclohexylphenol and lauryl thiocyanate

(rhodanate) were effective against eggs of *Aphis pomi*, DeG., on apple, giving over 95 per cent. control and thus comparing favourably with coal-tar distillate, which is very disagreeable to use. Sodium dinitro-o-cresylate (dinitro-o-cresol at 2·5 to 2·9 lb. per 100 U.S. gals.) was effective when applied in January, February or March, and the use of petroleum oil with it increased the effectiveness of the spray. Dinitro-o-cyclohexylphenol in oil was effective when applied in spring or autumn at concentrations of not less than 9·5 oz. per 100 U.S. gals. diluted spray, but lighter concentrations (4·9 to 7·4 oz.) often gave inadequate control, particularly in the autumn. It was very toxic to the eggs when applied in March. Lauryl thiocyanate was a very effective ovicide, but was too toxic to fruit buds to be considered further.

Stearns (L. A.), Kadow (K. J.) & Goodwin (M. W.). **Effect of Copper Fungicides on Lead-Arsenate-Lime and fixed Nicotine-Oil Sprays for Codling Moth.**—*J. econ. Ent.* **32** no. 2 pp. 270–273. Menasha, Wis., 1939.

The first year's results of experiments begun in Delaware in 1938 to establish a spray programme for the control of pests and diseases of apples, without injury to the trees, are summarised with special reference to the codling moth [*Cydia pomonella*, L.]. The programme included 32 treatments, 22 of which are dealt with in this paper. Each treatment consisted of a delayed dormant spray of oil emulsion and tar oil, 2 pre-blossom sprays, a full-bloom spray, a petal fall spray and 10 cover sprays. The insecticidal ingredients were identical up to and including the first cover spray. For the subsequent cover sprays, one series of plots was treated with lead arsenate and lime alone and in combination with Bordeaux mixture and 7 proprietary insoluble copper compounds, and a second with a fixed nicotine (Black Leaf 155) alone, with oil and in combination with the copper fungicides. All lead arsenate sprays contained 3 lb. lead arsenate and 5 lb. lime per 100 U.S. gals. Diseases were unimportant during the season, but infestation by *C. pomonella* was heavy. The schedule that gave much the best control (71·1 per cent. fruit free from infestation or superficial injury) included pre-blossom applications of liquid lime-sulphur (alone or in combination with flotation sulphur) and petal-fall and first cover sprays of flotation sulphur, lead arsenate and hydrated lime, followed by Bordeaux mixture and lead arsenate. The correction of arsenical injury was excellent, and the amount of russet from light to moderate.

Hartzell (F. Z.). **Dormant Spray Problems in New York.**—*J. econ. Ent.* **32** no. 2 pp. 274–277, 3 refs. Menasha, Wis., 1939.

In experiments in western New York in 1936–38, the minimum concentrations of certain dormant sprays to give effective control of various insect pests of fruit trees were as follows (the percentage control considered effective is given in brackets after the name of the pest): Against *Aspidiotus perniciosus*, Comst. (about 100) on apple, 3 per cent. lubricating oil, 2 per cent. DN-oil (oil containing 4 per cent. dinitro-ortho-cyclo-hexylphenol); against severe infestation of *Lepidosaphes ulmi*, L. (80–90) on apple, 3 per cent. coal-tar oil, possibly 2½ per cent. DN-oil; against very severe infestations (at least 90) 4½ per cent. coal-tar oil, 2½ or 3 per cent. coal-tar oil plus 3 or 2½ per cent.

lubricating oil, 3 per cent. DN-oil, 1 per cent. Elgetol (a water-soluble mixture claimed to consist of a salt of dinitro-cresol and other ingredients); against *Anuraphis roseus*, Baker (85) on apples, 2½ per cent. coal-tar oil alone or plus 3 per cent. lubricating oil, 2 per cent. DN-oil; against *Myzus cerasi*, F. (85) on cherry, 2 per cent. coal-tar oil, probably 1½–2 per cent. DN-oil; against light to moderate infestations of *Spilonota ocellana*, Schiff. (60 to 85) on apple, 4½ per cent. coal-tar oil, 2½ or 3 per cent. coal-tar oil plus 3 or 2½ per cent. lubricating oil; against severe infestations (85–95), 6 per cent. lubricating oil, possibly 2½ per cent. coal-tar oil plus 3 per cent. lubricating oil or 1½ per cent. DN-oil; against very severe infestations (95 to 100), 6 per cent. lubricating oil with 0·25 per cent. nicotine sulphate, 2 per cent. DN-oil, 1 per cent. Elgetol; against severe infestations of *Psylla pyricola*, Först. (94) on pear, 3 per cent. lubricating oil, 2 per cent. coal-tar oil, 1½ per cent. DN-oil.

A list is given of the maximum concentrations of the various materials that it is considered safe to apply to apple, pear and cherry trees under conditions obtaining in western New York. Autumn treatment is not advised, on account of the injury that may result if the following winter is severe.

Worthley (H. N.) & Steiner (H. M.). **Control of Apple Aphids and European Red Mite by Coal Tar Oil and other Materials.**—*J. econ. Ent.* **32** no. 2 pp. 278–286, 3 figs., 18 refs. Menasha, Wis., 1939.

The present uses of sprays of tar oil (coal-tar creosote emulsion) are reviewed from the literature; they are effective as dormant sprays for the control of various pests, but are liable to cause injury to the trees, are of little or no value against eggs of *Paratetranychus pilosus*, C. & F., and appear to depress the action of lubricating oil against them. In experiments in Pennsylvania in 1937, a low-temperature tar oil (distilled from tar recovered in the carbonisation of soft coal at 450–500°C.), which seemed less caustic than the usual high-temperature tar oils (from tar produced at 925–1000°C.), from which it differed chiefly in its relatively high percentage of tar acids (high boiling) and of paraffins and naphthenes, gave complete control of eggs of *Anuraphis roseus*, Baker, on apple at 2·5 per cent. in soap emulsion, but had practically no effect on eggs of *P. pilosus*. However, in 1938, a mixture containing 2·4 per cent. of this oil and 4 per cent. lubricating oil gave better control (82·9 per cent.) of such eggs on prepared twigs than any other treatment tested. The low-temperature tar oil appeared to depress the ovicidal action of the lubricating oil less than high-temperature tar oil.

In field experiments in 1938, dormant treatments with sprays containing 2·4 per cent. low- or high-temperature tar oil and 4 per cent. lubricating oil were highly effective against *A. roseus*. The spray containing the low-temperature tar oil gave better control of *P. pilosus*, but scorched the buds severely, while the other spray did not injure them. A prepared emulsion of low-temperature tar oil (68 per cent. tar oil) at 4·5 per cent. controlled *A. roseus* and caused only very slight injury. DN-oils containing 4 and 2 per cent. dinitro-ortho-cyclo-hexylphenol, at 2 and 3 per cent., respectively, were also highly effective against *A. roseus*, as was the former against *P. pilosus*, but both retarded and scorched the buds. Green tip applications were all much less effective than dormant ones against *A. roseus* and

somewhat less so against *P. pilosus*. Among delayed dormant applications, 2 per cent. lubricating oil plus summer-strength lime-sulphur was only effective against *A. roseus* when nicotine sulphate (1 : 800) was added, and in both cases caused severe scorching; 2 per cent. lubricating oil with Bordeaux (2 : 6 : 100) and nicotine sulphate gave good control of *A. roseus*, fair control of *P. pilosus*, and did not harm the buds. Pyrethrum powder at 2 lb. per 100 U.S. gals. gave results somewhat inferior to nicotine sulphate when both were in combination with 12·5 U.S. gals. liquid lime-sulphur and 3 lb. lead arsenate. Both these sprays caused severe scorching. None of the materials gave really adequate control of *P. pilosus*. Unseasonably warm weather in March 1938 probably accounted for much of the scorching.

Driggers (B. F.) & O'Neill (W. J.). **Experiments with Nicotine for the Control of Codling Moth.**—*J. econ. Ent.* **32** no. 2 pp. 286–290, 2 refs. Menasha, Wis., 1939.

The following is substantially the authors' summary: Tests in 1937 and 1938 in New Jersey with a triple acting spray [*cf. R.A.E.*, A **26** 554] of nicotine sulphate, oil, and lead arsenate or fixed nicotine against the first brood of the codling moth [*Cydia pomonella*, L.] on apple showed that the addition of nicotine sulphate (1 : 800) to a spray mixture containing an ovicide and larvicide definitely improves the control. Lead arsenate was more effective as the larvicide than fixed nicotine. Spraying from the outside of the tree with multiple-nozzle rods as opposed to spraying from the ground with single-nozzle guns tended to trap the moths in the trees, thus increasing the kill and giving better control. Observations indicated that the full effects of the triple spray treatments were not obtained because moths drifted in from adjoining blocks of trees.

Pepper (B. B.) & Haenseler (C. M.). **Pyrethrum and Derris as a Control for the Six-spotted Leafhopper, a Vector of Lettuce Yellows.**—*J. econ. Ent.* **32** no. 2 pp. 291–296, 3 figs., 6 refs. Menasha, Wis., 1939.

The virus disease known as yellows, of which *Macrosteles divisus*, Uhl. [*R.A.E.*, A **26** 78] is the vector, seriously limits the production of autumn lettuce in New Jersey. Experiments on control were begun in 1936. Fencing was tried in 1936 and 1937, and in the latter year a tobacco cloth fence 7 ft. high reduced the percentage of diseased plants from 31·8 to 1, but this method is too costly for general use and makes irrigation of the crop almost impossible. In experiments in 1937 and 1938 on the effect of the immediate removal of plants seen to be diseased, the percentages of plants removed in the two years were 4·4 and 11·2, while the percentages of diseased plants in control plots were 12·9 and 23·0, respectively.

In small plot experiments with insecticides in 1936 and 1937, certain dusts gave high control of *M. divisus*, but in all cases, decrease of the disease was slight. This was thought to be due to migration of adult leafhoppers. In small plot experiments in 1938, there was a definite correlation between the nymphal population and the percentage of diseased plants in the various plots, but the percentage reduction of diseased plants was not so great as that of the nymphal population. In large plots in 1938, applications on 9th, 16th, 23rd and

30th August and 6th and 13th September of dusts of 50 lb. pyrethrum flowers (0·8 per cent. pyrethrins), 25 lb. sulphur and 25 lb. talc, 80 lb. Stemtox A (0·5 per cent. pyrethrins) and 20 lb. sulphur, and $18\frac{2}{3}$ lb. derris root (4 per cent. rotenone), 25 lb. sulphur and $56\frac{1}{3}$ lb. talc gave, respectively, 97·3, 94·5 and 97·8 per cent. reduction in nymphal population and 89·1, 85·8 and 88·8 per cent. reduction in diseased plants. The slightly lower control afforded by the second dust is thought to be related to the lower proportion of sulphur.

RICHARDSON (C. H.) & SEIFERLE (E. J.). **Stomach Poisons and the Two-Striped Grasshopper ; Special Reference to Arsenic and Fluorine Compounds.**—*J. econ. Ent.* **32** no. 2 pp. 297–300, 3 figs., 4 refs. Menasha, Wis., 1939.

The effectiveness of 8 chemical compounds, in baits of bran, water and molasses, as stomach poisons for adults of *Melanoplus bivittatus*, Say, was investigated in Iowa in 1936, when the grasshopper was widely distributed there and particularly abundant in the southern and western counties. The test insects were fed individually and the data were analysed statistically. The median lethal doses of arsenic trioxide, sodium arsenite as NaH_2AsO_3 and as As_2O_3, sodium fluosilicate and sodium fluoride were 0·026, 0·015 and 0·0095, 0·100 and 0·040 mg. per gm. body weight, the figure for sodium fluoride being provisional. These are compared with the median lethal doses of some of these compounds to *M. femur-rubrum*, DeG., and *M. differentialis*, Thos. [*R.A.E.*, A **20** 695 ; **21** 341]. Sodium arsenite had the quickest action and sodium fluoride the slowest. Of the other compounds, the median lethal doses of which were not determined, cryolite (containing 84·3 per cent. Na_3AlF_6) was lethal at dosages between 0·2 and 4·8 mg. per gm. body weight, with no recoveries after doses greater than 1·4 mg., and barium fluosilicate gave complete kill at dosages between 0·6 and 2·8 mg. Chloroacetamide was lethal at from less than 0·1 to about 3·0 mg., but appeared to be repellent. Thiodiphenylamine (phenothiazine) was not toxic at dosages up to 5·8 mg. per gm. body weight.

DOUGLAS (W. A.). **Studies of Rice Stinkbug Populations with special Reference to Local Migration.**—*J. econ. Ent.* **32** no. 2 pp. 300–303, 2 figs., 1 ref. Menasha, Wis., 1939.

Solubea pugnax, F., one of the most important pests of rice in Louisiana, Texas and Arkansas [*R.A.E.*, A **16** 385 ; **26** 218], passes the winter in the adult stage in grass and rubbish in and near the rice-fields. The bugs leave hibernation in April, and before the rice-fields are entered, 2 or 3 generations are produced on the grasses that serve as wild food-plants. A list is given of these, of which the most important is *Paspalum urvillei*. The Pentatomid has not been found feeding on any cultivated crop except rice. As soon as the panicles emerge, millions of individuals enter the rice-fields, the adults by flight and the nymphs by crawling or swimming. As the adults take flight at the least disturbance, movements are greatly influenced by the cutting of a field of early rice or of grass by the roadside. The average maximum population for Louisiana is 2,430 bugs per acre, and the maximum recorded population was 18,446 per acre, in Texas. The average population is 750 bugs per acre 1–3 days after the panicles emerge. Population builds up at the rate of about 1,000 per acre

per week until the rice kernels become too hard for feeding, 8–10 days after fertilisation. One complete and three partial generations develop in the rice-fields. Rain and wind hinder feeding by knocking the nymphs off the panicles and causing the adults to seek shelter among the leaves. Graphs based on the results of sweeping in six rice-fields in 1936 and 1937 show the changes in populations of adults and nymphs due to migration to the fields, breeding in them, and migration from them to the grasses and levees, which are the most common places for hibernation. There was a highly significant difference in the number of bugs caught per day and in different situations, but no significant difference in the number of bugs feeding at different times of the day between 8 a.m. and 5.30 p.m. or in respective situations at different times of the day. There was no direct proportion between the number of bugs in a field and the abundance of wild food-plants growing within or around it. Bugs were abundant in fields in or near which there were no wild food-plants.

Ewing (K. P.) & Crawford (H. J.). **Egg Parasites of the Cotton Flea Hopper.**—*J. econ. Ent.* **32** no. 2 pp. 303–305, 1 ref. Menasha, Wis., 1939.

In June 1936, 57 eggs of *Psallus seriatus*, Reut., suspected of containing parasites, were removed from *Croton* plants and isolated, and a Mymarid parasite emerged from each ; 3 of these were identified as *Anaphes anomocerus*, Gir., and 54 belonged to the species subsequently described as *Erythmelus psallidis*, Gah. [*R.A.E.*, A **26** 227]. The latter later emerged from eggs in *Croton* plants collected in Arizona, Arkansas, Louisiana, Mississippi, South Carolina and Texas and the former from eggs in *Croton* plants from Arizona and Texas only. Of 41,947 eggs in the stems of various plants collected in 6 States during 1936 and 1937, 30·2 per cent. were parasitised. A list is given of the plants bearing eggs from which each species of parasite emerged. In most cases, *E. psallidis* greatly predominated or was the only parasite present. Both species develop singly in a host egg.

The adults of *E. psallidis* pair soon after emergence, the sexes occurring in approximately equal numbers. Emergence from eggs in field-collected plants usually took place by the 12th day, though 13–18 days were sometimes required. Two adults from eggs exposed to parasitism in the laboratory emerged on the 10th and 12th days. Anthocorids of the genus *Orius* were observed feeding on the adults in emergence cages. Two individuals of *E. psallidis* were reared from isolated overwintering eggs, and 113 others emerged in the spring from eggs in plants that grew the previous season. This parasite was reared in small numbers from eggs on wild plants infested by Capsids other than *P. seriatus*, but evidently had a very definite preference for eggs of the latter.

Roark (R. C.). **Insect Pests of Derris.**—*J. econ. Ent.* **32** no. 2 pp. 305–309, 39 refs. Menasha, Wis., 1939.

Two lists are given of insects and a mite that attack plants and stored roots of *Derris* : an alphabetical one, showing the part of the plant affected and the species if other than *D. elliptica*, and the reference to the record in the literature, and another of the pests classified by orders and families. Members of 25 families of insects are included. It is probable that pests of *Derris* would also attack *Lonchocarpus*.

Means of preventing or controlling infestation of stored roots by boring beetles and of the growing plants by the Galerucid, *Craniotectus corbetti*, Laboiss., are suggested from the Malayan literature.

Dozier (H. L.). **Studies of Control Measures for Sweetpotato Weevil in Louisiana.**—*J. econ. Ent.* **32** no. 2 pp. 313–318, 2 figs., 3 refs. Menasha, Wis., 1939.

Investigations on the control of *Cylas formicarius*, F., in seed sweet potatoes were carried out in Louisiana in 1936–37. Germination was improved by submergence in cold water for 48 hours, but was impaired by submergence for 72 hours or more. All stages of the weevil survived submergence for as long as 5 days. In tests with various chemical solutions and emulsions in cold water, ten were highly toxic to the weevil. Submergence for 48 hours in carbon bisulphide emulsion (the most toxic of the ten) at the rate of 3 oz. per U.S. gal. water is thought to be satisfactory. Sweet potatoes treated by the cold-water dip method should be covered with only a few inches of soil, except when there is danger of frost. In tests of fumigants, nearly all experiments were made at atmospheric pressure, as it was desired to find a fumigant that could be successfully used in any kind of air-tight container. Methyl bromide, a mixture of ethylene dichloride and carbon tetrachloride (3 : 1 by volume) and trichlorethylene proved to be extremely toxic to all stages of the weevil. All are cheap, non-inflammable and non-explosive and have no toxic effect on dormant sweet potatoes, and though they may blacken the shoots of sprouting sweet potatoes, leave vitality uninjured. Methyl bromide was the quickest acting and most effective compound. A dosage of 5 cc. to 50 cu. ft. gave complete kill of all stages in 12 hours at 88°F. The mixture of ethylene dichloride and carbon tetrachloride, used at the rate of 12 oz. to 50 cu. ft. for 24 hours, usually gave complete mortality. Trichlorethylene was less toxic and slower in action. Results with tetrahydronaphthalene were entirely negative.

Fahey (J. E.) & Rusk (H. W.). **Possible Changes in Ratio of Lead to Arsenious Oxide in Lead Arsenate Residues on Apples.**—*J. econ. Ent.* **32** no. 2 pp. 319–322, 13 refs. Menasha, Wis., 1939.

The following is from the authors' summary : In experiments undertaken in southern Indiana in 1935 and 1936 to determine the extent of decomposition of lead-arsenate spray residues on apples and apple foliage, the average ratio of lead to arsenious oxide in the samples did not vary significantly from that in the original spray material, and samples taken immediately after spraying showed no significant difference from those taken after weathering [*cf. R.A.E.*, A **27** 139]. The slight variations between the ratios are considered to be the combined analytical errors of the methods of residue analysis. The high ratios obtained by early investigators [**16** 394] are attributed to inadequate samples or to unreliable methods of analysis.

Strickland (E. H.). **Life Cycle and Food Requirements of the Northern Grain Wireworm, *Ludius aereipennis destructor* Brown.**—*J. econ. Ent.* **32** no. 2 pp. 322–329, 5 refs. Menasha, Wis., 1939.

A report is given of studies on the habits and control of *Corymbites* (*Ludius*) *aeripennis destructor*, Brown, in Alberta, continuing those in

1925–27, the results of which have already been noticed [*R.A.E.*, A **16** 328]. Three types of cages used in the studies are described. Summer mortality of the larvae was high and was increased in some years when the sowing of seed was somewhat delayed. This was due to cannibalism. Carabids destroyed many of the larvae in some of the cages. In field cages, in which conditions approximated to those occurring in the field, the length of the life-cycle varied from 4 to 9 years. The rate of growth, particularly during the first 3 years after hatching, was very erratic [*cf.* **23** 538], but differences were reduced in subsequent years. The number of larval instars varied from 10 to 24 or more. Larvae in the first two or three instars died of starvation in a few weeks unless they had access to suitable living vegetation. More mature larvae can live for at least 3 years in soil in which no vegetation is present. Newly hatched larvae would feed to some extent and often freely on the rootlets and stems of practically any plant, but when feeding on many plants, they died as soon as those that had not fed. In general, monocotyledons were necessary for their development. Very few survived for any length of time on dicotyledons. In field cages, survival was higher on cultivated fodder grasses than on grain crops.

NASH (R. W.). **The Yellow-headed Spruce Sawfly in Maine.**—*J. econ. Ent.* **32** no. 2 pp. 330–334, 1 fig., 3 refs. Menasha, Wis., 1939.

Pikonema alaskensis, Rohw., was first noticed in Maine in 1934 on *Picea abies* (*excelsa*), and has since been found to be widely distributed in the State and in some places abundant, on this and two other species of spruce (*P. rubra* and *P. glauca*). Its distribution in Canada and the United States and the species of *Picea* on which it has been recorded are given, together with notes on the injury caused, which is principally to the new foliage on young trees. The synonymy is discussed [*R.A.E.*, A **26** 293], and all stages and both sexes are described. Adults emerge at the end of May in southern Maine, and oviposit freely then and in early June. They are moderate flyers, most active on warm, sunny days, and do not go far from the trees under which they developed. Eggs are laid singly in shallow slits on the outer part of the young needles, usually at the base, and occasionally in the stem part of the new growth. The incubation period lasts 6–8 days, and the feeding period of the larvae 30–40 days. The prepupae drop from the trees and spin cocoons in the ground during July. Pupation occurs in the following spring. In one case, the pupal stage was observed to last 6 days at 74°F. Eggs were parasitised by *Trichogramma minutum*, Riley, larvae by *Ptychomyia* (*Bessa*) *selecta*, Mg., and prepupae in cocoons by a species of *Monoblastus* and two species of *Ichneutes*, one possibly *I. fulvipes*, Cress, and the other probably undescribed. For control, ornamental spruce should be sprayed during the first week of June with a mixture of 4 lb. lead arsenate, 4 oz. linseed oil or fish oil and 100 U.S. gals. water, or with nicotine sulphate (1 : 600) and soap (½ oz. to 1 U.S. gal.) if a non-arsenical spray is desired, but nicotine sulphate, even at 1 : 400, is not effective after the larvae reach the third instar. For plantations, one thorough spraying with lead arsenate for a serious infestation should check the sawfly for several years.

Goodhue (L. D.) & Gooden (E. L.). **Sedimentation and Microprojection Methods for determining Particle-size Distribution of Insecticidal Materials.**—*J. econ. Ent.* **32** no. 2 pp. 334–339, 3 figs., 7 refs. Menasha, Wis., 1939.

The following is substantially the authors' summary: The particle-size distribution of 3 commercial samples of sulphur was determined by sedimentation [*R.A.E.*, A **26** 739] and by microprojection. There was no difference between the methods as regards precision, but results were more easily obtained by sedimentation. Improvements in apparatus for both methods are described.

Doucette (C. F.). *Micromyzus oliveri* **Essig as a Greenhouse Pest.**—*J. econ. Ent.* **32** no. 2 pp. 342–343, 2 figs., 1 ref. Menasha, Wis., 1939.

Late in the autumn of 1936, Aphids, later identified as *Micromyzus oliveri*, Essig [*cf. R.A.E.*, A **24** 247], were noticed on an ornamental *Allium* in a greenhouse at Sumner, Washington. Some alate forms were present. The infestation was allowed to develop naturally; it decreased gradually in April, May and early June 1937 and had apparently disappeared by mid-June. Late in August, however, sparse colonies of apterous individuals were noticed, and reproduction, which was slow until October and November, then became rapid. It is thought possible that the infestation was carried through the summer on chickweed (*Stellaria media*). No Aphids were found on *Calendula officinalis* [*cf. loc. cit.*] growing out of doors on the east side of the greenhouse, and no infestation developed on small plants of *Calendula* placed in infested chickweed. A list is given of 21 plants, belonging to 15 genera, on which feeding and reproduction were noticed in the greenhouse. They included onion, celery, cabbage and cauliflower. The Aphids prefer the lower surface of the leaves, but are also found on the stems and flowers. Infestations on experimental plants were controlled by spraying with nicotine sulphate (1 : 800) plus 1 oz. soap per U.S. gal.

Shadle (A. R.). **Dryer and Protector for Insects.**—*J. econ. Ent.* **32** no. 2 pp. 343–344, 1 fig. Menasha, Wis., 1939.

A description is given of an apparatus used with considerable success during the rainy summer of 1938 in New York State to protect insect specimens from rodents, carpenter ants (*Camponotus herculeanus pennsylvanicus*, DeG.) and slow drying with the resultant growth of fungus.

Phillips (W. R.), Monro (H. A. U.) & Allen (C. E.). **Some Observations on the Fumigation of Apples with Methyl Bromide.**—*Sci. Agric.* **19** no. 1 pp. 7–20, 1 pl., 17 refs. Ottawa, 1938.

Phillips (W. R.) & Monro (H. A. U.). **Methyl Bromide Injury to Apples.**—*J. econ. Ent.* **32** no. 2 pp. 344–345, 1 ref. Menasha, Wis., 1939.

In experiments carried out at Montreal in 1937, which are described in the first paper, exposure for 1, 1½ and 2 hours to 2·5 lb. methyl bromide per 1,000 cu. ft. with an initial vacuum of 3 ins. absolute pressure reduced after the introduction of the fumigant to 27 ins.,

and vault and fruit temperatures of 80–82 and 75–78°F., respectively, gave complete kill of all larvae of *Rhagoletis pomonella*, Walsh, in apples from Ontario in the stage of maturity in which they are usually shipped, at which stage they may be assumed to have contained small larvae and a few eggs. This and other preliminary experiments indicated that the treatment is also effective against eggs. Exposure for 30 minutes did not kill all the larvae. When examined in January 1938, apples that had been fumigated with methyl bromide in a sustained vacuum were severely injured internally, those fumigated with methyl bromide or a mixture of methyl bromide and carbon dioxide at atmospheric pressure and by the standard dissipated vacuum treatment, and with methyl bromide and carbon dioxide in a sustained vacuum, were also injured internally, though much less severely. In all cases in which a vacuum was employed, the use of carbon dioxide considerably reduced injury. External injury was slight in all cases. Carbon dioxide treatment and vacuum treatment alone and in combination caused no injury. Except in the case of fruit treated with methyl bromide in a sustained vacuum, injury was as apparent on removal from store as after exposure to ripening temperatures. There was no significant difference in the extent of injury to apples stored at 32 and 39°F. Apples picked at the time recommended for commercial gathering were much more resistant to injury than those picked earlier or later. All fruit, whenever picked, was much more tolerant to methyl bromide if left in storage for a certain time before being fumigated. Only slight injury was caused by the dissipated vacuum treatment to apples that had been stored for 2 weeks, and no injury to apples stored for 6 weeks. The bromide residue was not sufficiently great to be harmful to man.

In observations made in the autumn of 1938 and recorded in the second paper, apples of 5 varieties shipped to Montreal from different parts of Canada and subjected to a dose of 2·5 lb. methyl bromide per 1,000 cu. ft. for 1½ hours, with an initial vacuum of 3 ins. absolute pressure dissipated to 28 ins. after the introduction of the gas, and vault and fruit temperatures of 80 and 60–70°F., respectively, were quite uninjured, whether treated immediately after arrival or after being stored for 2 weeks, while apples of 2 other varieties suffered only external injury.

PALMER (M. A.). **Two unusual Species of Aphids infesting Wheat.**—*J. econ. Ent.* **32** no. 2 pp. 345–346, 2 figs. Menasha, Wis., 1939.

In the autumn and winter of 1938, wheat in north-eastern Colorado, southern Nebraska and adjacent parts of Kansas was heavily infested with two species of Aphids, which often occurred together. One of these was *Rhopalosiphum splendens*, Theo., which is not known to have been previously recorded from the United States. It may possibly have been introduced in the egg stage on some primary food-plant, but it seemed to be maintaining itself throughout the year on wheat in the viviparous form, no sexuales having been taken. The other species differs from *R. prunifoliae*, Fitch, in colour only. However, as the population in November and December was predominantly apterous and the primary food-plants of *R. prunifoliae*, apple and *Crataegus*, are very scarce in the infested region, it is thought that a distinct race or possibly species may be concerned. The apterous and alate viviparae of *R. splendens* are described.

Paul (L. C.), King (K. M.) & Berg (V. L.). **Summary of Saskatchewan Grasshopper Infestations, Autumn 1938 and Ratings of probable Outbreaks 1939.**—*Saskatoon Leafl. Dep. Agric. Canada* no. 54, 137 pp., multigraph, 1 fldg. map. Ottawa, Ont., 1939.

This is a summary of a survey similar to those carried out in the previous years [*cf. R.A.E.*, A **24** 444 ; **25** 342 ; **26** 440]. The area infested by grasshopper eggs was found to include practically all the agricultural part of Saskatchewan, and the intensity of infestation exceeded those of the previous three years.

Pickles (A.). **A new Froghopper Pest of Sugar-cane.**—*Trop. Agriculture* **16** no. 4 p. 84. Trinidad, 1939.

A severe outbreak of *Tomaspis guppyi*, Urich, which has hitherto been considered rare in Trinidad, occurred in January 1939 over an area of 150 acres of sugar-cane fields, including both plant and ratoon canes of several varieties, on an estate on which this Cercopid had been present since 1935 without causing appreciable damage. Injury to the variety Co. 213, which is generally resistant to the common froghopper, *T. saccharina*, Dist., was fairly severe. The degree of infestation varied, but in some cases as many as 700 individuals were observed on a single stool. As a result of adult feeding, pale streaks, which later become dry and brown, developed on the leaves. Samples of juice from heavily infested plants showed a high degree of purity and a low soluble solid content.

The eggs are deposited in green tissue near the midribs of the leaves, and hatch after 20 days. They are very susceptible to desiccation, and aestivation in this stage, which occurs in *T. saccharina* [*R.A.E.*, A **19** 457], has not been observed. The nymphs are generally found high up the stem, often among the top leaves, and rarely congregate at soil level.

The outbreak in 1939 is considered to have been the result of a gradual accumulation of populations induced by the abnormally wet season of 1938 ; it is unlikely to persist through the dry season or to recur in a normal rainy season. The control measure adopted was dusting the canes with pyrethrum powder, and, where this was impossible, burning and reaping them.

Goytia (A.). **Argentine Republic : Locust Invasion in 1938–39.**—*Int. Rev. Agric.* **30** no. 6 pp. M129–M130. Rome, 1939.

The invasion of Argentina by *Schistocerca paranensis*, Burm., in 1938–39 was less serious than in the preceding season, owing to vigorous control carried out by the usual mechanical methods. The first swarms were reported in the Province of La Rioja, and the movement spread to central and northern Argentina, eastwards to Corientes and Entre Rios and northwards to Formosa, and thence into Paraguay. Particulars of eggs, hoppers and adults destroyed in different Provinces are tabulated.

Frappa (C.). **Madagascar : Behaviour of the Red Locust** (*Nomadacris septemfasciata*) **from 1935 to 1938.**—*Int. Rev. Agric.* **30** no. 8 pp. M177–M179. Rome, 1939.

This is a brief account of the outbreaks of *Nomadacris septemfasciata*, Serv., in Madagascar between 1934 and 1938 [*cf. R.A.E.*, A **24** 236].

From 1936, the swarms were recorded in the centre as well as in the south-western part of the Island, and in 1938 they appeared in the north, so that this species is more widespread than was formerly thought. Laboratory experiments confirm that there is only one generation a year.

FROGGATT (J. L.). **Pests of Cocoa in the Territory of New Guinea.**—*New Guinea agric. Gaz.* **4** no. 4 pp. 66–68, 1 ref. Rabaul, 1938.

The most serious pest of cacao in the Territory of New Guinea is *Pantorhytes plutus*, Oberth. [*cf. R.A.E.*, A **27** 277]; which causes injury in New Britain. Cerambycids of the genus *Dictamnia* bore into the branches; the larvae can be destroyed by inserting a wire or introducing small quantities of paradichlorobenzene into their mines. *Calotermes papua*, Desn., which has also been found in the stems of old bushes of *Bixa orellana*, sometimes attacks the trunks of well-grown trees. A 5 per cent. solution of paradichlorobenzene in kerosene poured into the workings killed the termites without apparently harming the tree. Lepidopterous larvae and those of the weevil, *Orthorrhinus patruelis*, Pasc., have been observed boring in the branches, but they are not numerous. The adults of several Eumolpids of the genus *Rhyparida*, including *R. obscuripennis*, Jac., feed on the young leaves. They can be shaken off the trees and caught in a net or tin. Other insects that attack the foliage, but are of little or no importance, include the weevil, *Platyacus ruralis*, Fst., and larvae of *Tiracola plagiata*, Wlk., *Prodenia litura*, F., *Earias* sp., and an unidentified Limacodid. The pods are sometimes infested by fungous disease in the tunnels made by Lepidopterous larvae, and the Rutelids, *Parastasia inconstans*, Frm., and *P. marmorata*, Gestro, occasionally feed on the surface tissue.

Entomological Problems.—*Rep. Coun. sci. industr. Res. Aust.* **12** (1937–38) pp. 14–22. Canberra [1939]. **Weeds Investigations.**—*T.c.* pp. 22–27.

The estimated loss of peaches due to *Cydia molesta*, Busck, in the Goulburn Valley, Victoria, in 1937–38 was 5–10 per cent. [*cf. R.A.E.*, A **26** 448], and the outbreak in the Murrumbidgee irrigated district in New South Wales remained light. The unsatisfactory results obtained with sprays in 1936–37 [*loc. cit.*] were found to be due to their failure to penetrate the clusters of fruit and cover the stem end of the peach, the rapid growth of young twigs, the tendency of the moths to deposit their eggs on the unsprayed tips, and the ability of newly hatched larvae to recover from the effects of the nicotine bentonite over which they have crawled. Two consignments of the parasites, *Macrocentrus ancylivorus*, Rohw., *Glypta rufiscutellaris*, Cress., *Microdus* (*Bassus*) *diversus*, Mues., *Angitia* (*Dioctes*) *molestae*, Uch., and *Ascogaster carpocapsae*, Vier., were received from the United States and bred in a special insectary. Some 4,000 individuals were liberated, and 4 generations of *Macrocentrus ancylivorus* were recovered during the summer and a few individuals early in the spring, so that the species is thought to have overwintered in the field. *Microdus diversus* was also recovered, but it appeared to die out towards the end of the season. In experiments on the fixation of nicotine for use against *Cydia pomonella*, L., it was found that nicotine could be combined

with bentonites from New Zealand and Western Australia and with brown coal and peat, though the proportion absorbed was not always so high as with the American bentonites, and the deposit tended to adhere even more to the fruit and foliage [*cf.* **26** 555, 556, 733].

In studies on locust outbreaks [*cf.* **26** 583], measurement of over 1,000 individuals showed the existence of phase differences between solitary and swarming individuals in *Austroicetes cruciata*, Sauss., as well as *Chortoicetes terminifera*, Wlk., and *Gastrimargus musicus*, F. [**26** 449], but not in *Oedaleus australis*, Sauss. All the regular outbreak centres of *C. terminifera* were between the 17 and 25 in. isohyets in the zone between the summer and winter rainfall regions and occurred on open pasture land. Breeding experiments with colour varieties of *C. terminifera* showed them to represent definite genetic types. Various parasites were observed in the course of work on grasshoppers [*cf.* **25** 633; **26** 629; **27** 56, 57], including *Sarcophaga depressa*, R.-D.

Three consignments of the Tachinid parasite, *Hexamera*, were liberated in Victoria against *Oncopera* [**25** 321]. As the larvae of the latter in Australia are not in a suitable stage to be attacked until near the end of the active period of the Tachinid in New Zealand, areas of early infestation are to be prepared artificially in Victoria to assist in the establishment of the parasite, which, once established, may be able to adapt itself to local conditions. Subterranean clover [*Trifolium subterraneum*] and oats were the crops most seriously damaged by *Halotydeus destructor*, Tucker. Dressing with superphosphate, grazing, mowing and burning were all unsuccessful as methods of control. Clean fallowing was effective, but is rarely practicable, and re-infestation soon occurred. A permanently fallowed strip 60 ft. wide was not an effective barrier. Observations on the native parasites of *Ochrogaster contraria*, Wlk., which does extensive damage to the boree tree [*Acacia*] were continued. The life-cycle of the egg parasite, *Eupelmus flavicallus*, is normally completed in a few weeks in spring, but a proportion of the larvae enter a diapause and do not give rise to adults until the following spring. Some larvae of the Pyralid, *Titanoceros thermoptera*, Lower, which prey on the eggs, enter a similar diapause, the adults emerging in the following year soon after the eggs of *O. contraria* have been laid. A small consignment of *Angitia fenestralis*, Hlmgr., was obtained from New Zealand and liberated in New South Wales against *Plutella maculipennis*, Curt., on cabbage.

Two methods of testing the resistance of samples of timber to attack by *Eutermes exitiosus*, Hill, have been evolved. These are field testing [*cf.* **26** 449] and laboratory testing, in which standard colonies of termites are maintained in glass jars under constant temperature and humidity. Surveys indicated that about a dozen species of termites attain economic significance in Australia. These belong to the genera *Mastotermes*, *Calotermes*, *Porotermes*, *Rhinotermes*, *Coptotermes*, *Heterotermes*, *Eutermes*, *Microcerotermes*, and *Amitermes* (*Hamitermes*). *E. exitiosus* is the third in order of importance. Within the limits of its range, *Mastotermes darwiniensis*, Frogg., which occurs only in the tropics, offers a more acute problem than any other species; its depredations include almost every type of damage for which termites are responsible. *Coptotermes acinaciformis*, Frogg., is the most important species, as it occurs over nearly the whole of Australia. It causes most of the damage to buildings, poles, etc., and also attacks

fruit trees, hardwood forests in New South Wales and crop and garden plants. *C. raffrayi*, Wasm., and *C. frenchi*, Hill, do considerable damage in restricted areas, the latter being a pest of growing timber in parts of New South Wales.

It has been discovered that the species of *Chermes* infesting pine in Australia [*cf.* **20** 166, etc.] is not *C.* (*Pineus*) *pini*, L., but *C.* (*P.*) *boerneri*, Annand, which is restricted to *Pinus radiata* in the United States, where a survey of natural enemies is to be made. Consignments of *Habrolepis dalmanni*, Westw., were obtained from Tasmania and New Zealand and liberated in Canberra during November in plantations of oak (*Quercus robur*) infested by *Asterolecanium variolosum*, Ratz., and recoveries have been made. *Lampyris noctiluca*, L., which was introduced into Canberra for the control of *Helix aspersa* [*cf.* **26** 449–50], has apparently failed to become established.

The second section includes notes on insects introduced or suitable for introduction for the control of noxious weeds [*cf.* **27** 282]. Eggs of *Chrysomela geminata*, Payk. [*cf.* **25** 321] and overwintering larvae of *Agrilus hyperici*, Crtz., on living plants were introduced for the control of *Hypericum perforatum*. Several hundred adults of *Euaresta aequalis*, Lw., that had emerged from material received from the United States during the previous season were dispatched for liberation against Noogoora burr (*Xanthium pungens*). Feeding tests showed that adults of *Dectes spinosus*, Say, would feed slightly on certain economic plants, but oviposited only on *X. pungens* and a few other Compositae, of which the only economically important one was artichoke. Roots containing *Baris* [*interstitialis*, Say] were received from the United States and tests are being carried out with a view to its liberation against the same weed, but work on *Ataxia hubbardi*, Fisher, has been discontinued as its food-plants are numerous. *Teleonemia lantanae*, Dist., is firmly established in Queensland against *Lantana camara* and is becoming established in New South Wales. A further consignment has been sent to Norfolk Island, as the colony there had disappeared [*cf.* **26** 87]. Larvae of *Bactra truculenta*, Meyr., and *Athesapeuta cyperi*, Mshl., were received from Hawaii, for feeding tests with a view to liberation against *Cyperus rotundus*.

CHAMBERLAIN (E. E.) & TAYLOR (G. G.). **Spotted Wilt. Host Range and Transmission by Thrips.**—*N.Z. J. Sci. Tech.* (A) **20** no. 3 pp. 133A–142A, 6 figs., 12 refs. Wellington, N.Z., 1938.

An account is given of investigations carried out in a glasshouse in New Zealand in 1936–37 in which the virus of spotted wilt was transferred by inoculation of sap from diseased tomatos to healthy plants of 7 families comprising potato, lettuce, *Nicotiana rustica* and 16 species of flowering plants and weeds, and from naturally infected ornamental plants of 7 species to healthy plants of tomato and tobacco [*N. tabacum*]. The disease was not transmitted to 12 plants in which it has been recorded elsewhere, but this is not regarded as proof of their immunity in New Zealand. The literature on the transmission of spotted wilt by *Frankliniella insularis*, Frankl., which has not been recorded in New Zealand, and *Thrips tabaci*, Lind., is reviewed [*R.A.E.*, A **20** 212; **22** 22; **23** 1, 166; **24** 156], and an account is given of investigations carried out in 1935–36 on the transmission of the virus by *T. tabaci*, which is common in New Zealand, where it infests a wide range of plants, including tomato. When larvae from diseased tomatos in the

glasshouse were transferred to healthy tomato plants and allowed to feed on them for 2–7 days, 14 out of 64 plants developed symptoms after 20–35 days; 2 out of 4 tobacco plants were similarly infected, after 13 days, by larvae from diseased tomatos. Symptoms appeared after 30 days in 3 out of 11 tomato plants infested with larvae and adults taken from naturally infected plants in the field. The symptoms were in some cases milder and the incubation periods longer than infections resulting from mechanical inoculation. All the control plants remained healthy.

MORRISON (L.). **Surveys of the Insect Pests of Wheat Crops in Canterbury and North Otago during the Summers of 1936–37 and 1937–38.**— *N.Z. J. Sci. Tech.* (A) **20** no. 3 pp. 142A–155A, 5 figs., 1 ref. Wellington, N.Z., 1938.

The principal survey was carried out in the summer of 1937–38 when the only important insects infesting wheat in the wheat-lands of the eastern part of the South Island of New Zealand were *Mayetiola destructor*, Say, *Hyperodes griseus*, Hust., and *Cerodontha denticornis*, Mg. There were evidently two main generations of *M. destructor* during the season, as the larvae were numerous in spring and again in late summer. Most of the spring larvae had pupated by mid-November, and adults emerged at the beginning of December. The resulting larvae were abundant from mid-January, especially in second-growth wheat, which came up as a result of rains in December following a very dry spring and remained green during January while the main crop was ripening. A single stem often harboured 15–30 larvae. Most of them pupated towards the end of the month, and some of the pupae would probably give rise to adults in the autumn, whereas others would not do so until the spring. The percentage parasitism of pupae collected in December and January was very low.

Although *M. destructor* occurred throughout the area surveyed, it caused serious injury only in parts of South Canterbury and North Otago, where the percentage infestations averaged 9·17 and 7·8, respectively. The percentages of infestation in various localities and in the four commonly grown varieties of wheat, of which two showed comparative resistance, are shown in figures and discussed. Infestation is probably not related to soil or climatic conditions, which vary considerably throughout the area of high incidence. The pupae overwinter in the straw and stubble, some occurring below ground level, and so are best destroyed by burning and ploughing deeply. In the area surveyed, however, grass is commonly sown with wheat and barley, and the stubble is therefore neither burnt nor ploughed when the crop is reaped.

H. griseus was present in varying numbers in most wheat fields, although the average percentage infestation throughout the whole area was only 3–4. The adults of this weevil overwinter in the soil and it apparently has only one generation a year. The larvae, which are active from October till early December, tunnel the stems, making them less resistant to wind. They also attacked rye grass [*Lolium*] and were observed to cause considerable damage to barley. In 1937–38, pupation occurred in the soil, mostly during the last three weeks of December though some larvae were still present as late as mid-January. Late larvae burrow in the stem near the lower nodes and often cause straw-break in January. The pupal stage lasts 16–19 days, and adults

appear about 25th December. They attack a number of plants and readily feed on wheat, destroying irregular patches of the surface tissue on either side of the mid-rib of the young leaves. Infestation by the larvae may cause the complete destruction of late-sown spring crops, and abnormal thinness of autumn-sown crops.

H. griseus and *M. destructor* frequently infested the same plant; in the northern part of the district the former, and in the southern the latter, was the more destructive.

Cerodontha denticornis occurred in small numbers on wheat and barley throughout the area; it was most abundant in mid-Canterbury. The only forms observed were the pupae, which occurred singly between the stem and leaf sheath, generally attached to the latter. The economic importance of this Agromyzid is not known, but was slight in 1937–38. Noctuid larvae of several species damaged the wheat by biting through the stems below the ear, and an unidentified Lepidopterous larva was observed boring in the stalk about 6 ins. below the ear, but these were not of economic importance.

The survey during 1936–37 was carried out to ascertain whether Rhynchota are responsible for the condition known as "sticky dough" or "slimy gluten," which develops in certain strains of wheat from Otago and South Canterbury during fermentation [*cf. R.A.E.*, A **23** 119, etc.]. The most abundant of the bugs found on wheat were the Capsid, *Stenotus binotatus*, F., and the Lygaeids, *Hudsona anceps*, White, and *Nysius* sp., and in experiments in which the species were caged separately, they all fed on wheat grains and caused the development of "slimy gluten." This condition has not been observed, however, in many areas of New Zealand, though the bugs are widely distributed there, which suggests that wheat is not their normal food. *S. binotatus* is cosmopolitan, but the two Lygaeids are indigenous to New Zealand.

DUMBLETON (L. J.) & JEFFREYS (F. J.). **The Control of the Woolly Aphis by** *Aphelinus mali*.—*N.Z. J. Sci. Tech.* (A) **20** no. 3 pp. 183A–190A, 1 fig., 2 refs. Wellington, N.Z., 1938.

Since in some seasons in New Zealand effective control of the woolly aphis [*Eriosoma lanigerum*, Hsm.] on apple by *Aphelinus mali*, Hald., has not been established until late summer, and it has been suggested that the parasite resumes activity in spring later than it used to do soon after its introduction, investigations on the factors governing its efficiency were carried out during 1934–37.

In a brief discussion of the bionomics of *E. lanigerum*, it is stated that its distribution in New Zealand is restricted by the failure of the winged females to migrate in autumn to a primary food-plant and the fact that the apterous females are the only form responsible for the maintenance of the species. Distribution from tree to tree is attained by migration and by the dispersal of the young by wind or human agency; autumn migration to the roots apparently does not occur, but root infestation could in any case be prevented by the use of resistant root-stocks.

Young overwintered Aphids found on 2nd August and 17th September 1935 gave rise to adults that reproduced in approximately six and four weeks, respectively; during midsummer, when the average temperature in Nelson is 61°F., this development period

is probably reduced to 20 days, and there may be 9 or 10 generations between August and April. Alates were first observed in samples received from various parts of New Zealand during mid-February; they were most numerous in March and became rare in April. When summer alates were isolated in 1934 and 1935, they produced exclusively sexual progeny [*cf. R.A.E.*, A **14** 221; **24** 11] within a week, the maximum number, including both sexes, from one female being 7. When the sexual forms were caged together, eggs were found after a minimum of 17 days, but they failed to hatch although kept until the following summer. Alates formed 48 per cent. of a heavy Aphid infestation observed in March 1935.

Examinations of dead Aphids showed that by the middle of April the most numerous forms of *A. mali* in them were the full-fed larvae, which overwinter, but a few pupae and adults, which might appear in late autumn, were also present. In 1935 and 1937, pupation began early in August and was nearly complete by early September. Adults were first observed in the field in different localities on the South Island between 19th September and 5th October in 1935, and between the beginning of September and 10th October in 1936, when most appeared about 20th September. These emergence dates are no later than those observed during the first few years after the establishment of the parasite in Nelson. Under laboratory conditions, the average periods required for development in the first spring generation and the mid-summer generations were 47·7 and 18·5 days, respectively; thus there are probably 8 generations between September and April. Approximate estimations of the percentage parasitism in the field based on monthly examinations in 1935–36 of batches of Aphids, including alates, which are also parasitised, collected from 14 localities in the two islands, are shown in a table. A few newly parasitised Aphids were present in October, and the maximum percentage, which averaged 65·8, was reached in March, after which it decreased. The frequency of parasitism appears to depend on the density of the Aphid population, and effective parasitism is hindered by the sporadic distribution of the Aphid on the tree and in the orchard, and the slowness with which *Aphelinus* spreads.

Overwintering individuals of both *Eriosoma* and *Aphelinus* give rise to adults, and females begin to reproduce, at about the same time in spring; the females produce approximately equal numbers of progeny (about 100) and both species can survive low temperatures in winter. The increase of the Aphid is greatly favoured, however, by the slightly larger initial spring population, by the exclusive production of females, whereas males form half the progeny in *Aphelinus*, by the slightly higher rate of development at both low and high temperatures, and by continued activity in autumn after that of *Aphelinus* has ceased. In normal years, biotic factors probably favour *Aphelinus*, no parasites of which are known in New Zealand.

Sprays applied in winter, when the overwintering parasites have completed feeding and are protected by the bodies of the dead hosts, are probably more effective in reducing *Eriosoma* without injury to *Aphelinus* than those applied in summer, when many living Aphids containing eggs and young larvae of the parasite are killed. In experiments carried out during 1937 in which Aphids containing overwintering parasites were dipped on twigs of apple into oil emulsions containing from 2 to 10 per cent. oil, the mortality of *Aphelinus* varied from 22·8 to 58·8 per cent. as compared with 10 per cent. in controls, and a

still higher mortality would probably result from applications in early September, when the parasite is in the pupal stage, of the 3 per cent. oil recommended against *Eriosoma* and the red mite [*Paratetranychus pilosus*, C. & F.].

It is suggested that prunings bearing parasitised Aphids should be obtained in mid-April, before predators reduce the overwintering population, stored in a dry shed protected from birds, and placed in spring on all trees noticeably infested with Aphids. Attempts to force earlier emergence by the use of artificial heat are not advised.

DUMBLETON (L. J.). **The Lucerne Flea** (*Smynthurus viridis*) **in New Zealand.**—*N.Z. J. Sci. Tech.* (A) **20** no. 4 pp. 197A–211A, 6 figs., 9 refs. Wellington, N.Z., 1938.

Smynthurus viridis, L., was first recorded from New Zealand by W. M. Davies [*R.A.E.*, A **16** 230], though he did not state on what information or material this record was based, and was taken on the North Island by Cottier in October 1929. In the present paper, the results are given of a survey in 1937, which showed it to be widespread on lucerne and clover in parts of both the North and South Islands; its distribution is indicated on a map. Eggs have been found in soil from samples of seeds of subterranean clover [*Trifolium subterraneum*]; they readily withstand desiccation and it is probable that *Smynthurus* was originally introduced from Australia in the egg stage with consignments of imperfectly cleaned seed, before the vacuum fumigation of imported seed of this clover was made compulsory. Notes are given on its bionomics and control and the injury it causes to its food-plants [*cf.* **16** 381; **21** 406]; its apparent preference for lucerne and subterranean clover may be due to the fact that its increase is favoured by the climatic conditions necessitating their use and the fact that they are grown in almost pure stands that are frequently undisturbed except for periodical cutting. Infestation can be reduced by introducing grass into stand of clover and reducing the proportion of clover in pasture, while cattle increase mortality by trampling and by opening up the sward, so exposing the springtails to heat and desiccation.

Observations on *S. viridis* were made in four localities during 1937–38 and correlated with the prevailing conditions of temperature and soil moisture, expressed as the ratio of rainfall to saturation deficiency [**21** 521], and with those that normally occur, both of which are shown on graphs. Serious injury was caused to various clovers in a mixed pasture left for hay in one district, and to subterranean clover in another, but the springtail is not expected to become of economic importance in either. Conditions were generally unfavourable in the others.

It is considered unlikely that *S. viridis* will become a serious pest in the high-rainfall districts of the North Island, but where rainfall is low, favourable conditions prevail, since the pronounced summer dryness induces aestivation, which apparently favours rapid increase in autumn, winter temperatures are too high to cause mortality, and subterranean clover is widely grown. On the South Island, *S. viridis* will probably be less important despite the increased use of subterranean clover, as the summer may be too wet to induce aestivation and unfavourable winter temperatures extend over progressively longer periods in proportion as districts are further south.

The Bdellid mite, *Biscirus lapidarius*, Kramer, the life-history of which is described from the literature [*cf.* **21** 408; **24** 134], was observed in 1937 on white clover [*T. repens*] and subterranean clover in association with Collembola other than *S. viridis*, and in 1938 on white clover pasture with *S. viridis*, in areas of high and evenly distributed rainfall. This predator was not found in the two localities studied in which serious outbreaks of *Smynthurus* were observed, and as it is not abundant in New Zealand, a consignment is to be imported from Western Australia, so that its effectiveness in controlling the springtail under New Zealand conditions may be studied.

[Smirnov (E. S.) & Polezhaev (V. G.).] **Смирнов (Е. С.) и Полежаев (В. Г.). On the Behaviour of *Lariophagus distinguendus* Först. a Parasite of the Granary Weevil *Calandra granaria* L.** [*In Russian.*]—*Zool. Zh.* **16** no. 6 pp. 999–1012, 5 figs., 9 refs. Moscow, 1937. (With a Summary in English.) [Recd. 1939.]

Laboratory observations in Moscow on the bionomics of the Pteromalid, *Lariophagus distinguendus*, Först., parasitising *Calandra granaria*, L. [*cf. R.A.E.*, A **14** 393] showed that unfertilised females laid fewer eggs than fertilised females and the progeny was exclusively male. The numbers of eggs laid by fertilised females fed on sugar solution averaged 50·2; individuals that were kept without food laid considerably fewer eggs and survived for shorter periods. Usually, only a single egg or larva was observed on a host, which indicates that the female can distinguish a parasitised from a healthy host. To determine its ability to distinguish infested grains, a few grains of wheat containing larvae of *C. granaria* were placed at different depths among as many as 6,000 or even 230,000 uninfested grains, and a female of *L. distinguendus* was placed on the top of each heap; subsequent examination showed that the majority of the larvae were parasitised, and that the parasites penetrated the heaps to a depth of 1 ft. Further tests with live and dead larvae of *C. granaria* showed that the parasite is guided by the sound produced by the feeding of the host larva and by its smell [*cf.* **14** 212]. The attractiveness of sound appeared to be approximately three times as great as that of odour. This was particularly evident in experiments in which intact wheat grains were placed between two vertical glass plates and infested grains were placed at the bottom on one side, while larvae of *Calandra* removed from grains and thus unable to produce sound were placed in a thin layer of cotton wool on the other side. Of 52 females of the parasite placed on the surface of the grain 42 reached the corner in which the attractive factors were the smell of the host combined with sound, and 10 females reached the corner in which the factor of sound was eliminated. The period within which the females found the infested grains varied from 7 to 260 minutes and probably depended on the degree of maturation of the eggs, individuals with incompletely developed ovaries being less active in their search for hosts.

[Rodionov (Z. S.).] **Родионов (З. С.). On the Habitats and the Spreading of Grain Mites.** [*In Russian.*]—*Zool. Zh.* **16** no. 6 pp. 1013–1021, 1 fig., 8 refs. Moscow, 1937. (With a Summary in English.) [Recd. 1939.]

Recent investigations on granary mites in Russia have shown that, contrary to the common belief, they are attracted to light as a source

of warmth, though they avoid it under conditions of high temperature in summer. Light cannot, therefore, check the spread of mites outside granaries. Surveys of fields and meadows in a number of Provinces in the Russian Union revealed the presence in them of all the common granary mites ; they were abundant in heaps of straw, hay and other vegetable matter, as well as in cereals and grasses stored in nests of rodents. Lists are given of the 17 mites observed by the author in granaries, and of 10 of these that also occurred in the field [*cf. R.A.E.*, A **25** 570]. Special experiments showed that grain mites move very slowly ; their rapid spread in fields and granaries is effected by their transport on agricultural implements, packing material, clothes, etc. They were carried into the fields with infested seed, and from the fields into the granaries with newly harvested grain. Mites were also found attached to the fur of rodents and the feathers of birds (sparrows and pigeons) that frequent granaries, and hypopi and adult mites were observed on fleas of rodents and on various insects infesting grain. In experiments, mites were transported by wind to distances of up to 65 ft.

On the basis of these investigations, it is suggested that heaps of grass, hay or straw should be removed from the fields, barns and threshing floors, rodents should be destroyed, grain in the granaries should be protected from birds, and infested grain should be cleaned far from open granaries.

[Nevskiĭ (V. P.).] **Невский (В. П.) Contribution to the Study of the Aphids of Central Asia.** [*In Russian.*]—*Bull. Univ. Asie cent.* **22** no. 34 pp. 291–298. Tashkent, 1937. (With a Summary in English.) [Recd. 1939.]

This paper comprises descriptions of two new species of Aphids and of hitherto unknown forms of others. They include the male and sexual female of *Macrosiphum* (*Acyrthosiphon*) *gossypii turanicum*, Mordv., from cotton in Transcaucasia, the alate viviparous female of *M.* (*A.*) *moltshanovi*, Mordv., which was found in very large numbers on peas and vetch (*Vicia*) in the Pamirs at altitudes of about 10,000–13,000 ft., and the apterous viviparous female of *M.* (*Macrosiphoniella*) *maculata*, sp. n., which was taken on lucerne (*Medicago sativa*) at an altitude of nearly 12,000 ft. in the Pamirs. The females of *M. gossypii turanicum* laid many winter eggs on cotton in the laboratory.

[Sinel'nikova (Z.).] **Синельникова (З.) The violet Scale-insect *Syngenaspis oleae* Colv. as an Orchard Pest of Middle Asia.** [*In Russian.*]—*Acta Univ. Asiae med.* (8, Zool.) fasc. 40, 22 pp., 6 figs., 8 refs. Tashkent, 1937. (With a Summary in English.) [Recd. 1939.]

Parlatoria (*Syngenaspis*) *oleae*, Colv., is an important pest of fruit trees in Central Asia, where it is widely distributed, being particularly abundant in eastern Uzbekistan. It has been recorded from over 18 species of plants, of which apple, pear, apricot, plum and peach are the most important [*cf. R.A.E.*, A **27** 474]. The trees are weakened by infestation and individual branches or whole trees dry up.

All stages of the Coccid are described in detail, and an account is given of observations on its bionomics carried out in 1929 and 1930 in Uzbekistan. There are two complete generations a year, fertilised

females of the second hibernating on the stems, shoots and branches of the trees. Oviposition begins in the second half of April and lasts for over a month, the eggs being deposited directly under the scale. The number of eggs laid by a female varied from 19 to 70, and averaged 40–45, and the period from oviposition until the crawlers emerged from under the scale lasted 6–12 days, and averaged about a week. The first crawlers were observed in the field at the end of April and beginning of May. They spread over the whole tree, and later settled on shoots, branches, leaves and fruits. Bright spots appear on all infested parts, with the exception of the leaves, but only about 23 per cent. of the larvae are capable of producing them. The sexes are practically undistinguishable in the first instar, which lasts 18 days in May and 15 in August. After the first moult, the males gradually turn into " pupae " and the adults emerge about 45–62 days after the eggs are laid. The females moult a second time and become adult before the males. Oviposition begins early in July, and the first larvae appear about the middle of the month. They are much more numerous than those of the preceding generation and are particularly harmful to the fruits of apples and pears. The adults appear from the end of August onwards ; the males die soon after pairing, and the females enter hibernation as soon as cold weather sets in. In the autumn, many individuals on the fruits are killed in the process of picking, sorting and packing, and those on the foliage die when the leaves fall. The low winter temperatures that prevail in Central Asia generally kill 25–90 per cent. of the hibernating females, and in the Tashkent district, practically all were destroyed in 1934 when the temperature fell to —30°C. [—22°F.].

In laboratory and field tests of various insecticides, the only one of any value was an emulsion of 37 parts carbon bisulphide and 63 parts kerosene, which, at a dilution of 8 per cent., gave about 90 per cent. mortality and did not scorch foliage or fruits. Spraying should be timed to kill the larvae, as the adult females are extremely resistant, especially when hibernating.

[Zakharov (L. Z.)] **Захаров (Л. З.). The Dynamics of the Propagation and Accumulation of the Asiatic Locust in the Reed Beds of the River Kuban and the Coast of the Azov Sea.** [*In Russian.*]—*Social. Grain Fmg* 1938 no. 4 pp. 148–171, 1 fldg map, 6 graphs, 25 refs. Saratov, 1939.

The hydrography, climate, soil and vegetation of the inundation region of the Kuban river, which serves as a permanent breeding area for *Locusta migratoria migratoria*, L., are analysed in detail to elucidate the factors responsible for fluctuations in the locust population.

The usually accepted theory that abnormally high spring floods kill locust eggs and reduce the infested area is erroneous, the effect of such floods being purely local and partial. On the contrary, high floods bring about changes in soil and vegetation that render newly flooded areas suitable for locust breeding. Another effect of high floods is to force locust swarms to the edges of the inundation region, where they are more easily noticed.

A comparison of the temperature and precipitation curves with the dynamics of the locust population shows that the outbreaks usually follow a sequence of 2–4 dry, hot years. These conditions cause higher fertility in the locusts, favour the survival of the eggs, and transform

swamps into meadows with vegetation suitable for locust breeding. Another important climatic factor is wind, which displaces the swarms, causing them to leave the inundation region for the surrounding steppes. The influence of soils on the distribution and survival of the eggs is uncertain, and the deposition of eggs depends on the presence of suitable food-plants. The influence of natural enemies on the balance of locust populations is purely local and temporary.

On the whole, the natural conditions of the Kuban inundation region are very favourable for the preservation and multiplication of locusts, and combinations of unfavourable factors are rather exceptional. The effect of the recent drainage of some parts of the inundation region has been essentially the same as that of drought, bringing about an increase, since the newly drained areas present particularly favourable conditions and are immediately invaded by locusts. It is only by a very extensive amelioration of the region that the areas suitable for locusts can be reduced; in the meantime a continuous watch must be organised and locust swarms kept down by annual control measures.

[Grivanov (K. P.).] **Гриванов (К. П.). On the Injuriousness of the Wheat Thrips** (*Haplothrips tritici*, **Kurd.**). [*In Russian.*]—*Social. Grain Fmg* 1938 no. 4 pp. 179–186, 1 graph, 5 refs. Saratov, 1939.

In the south-east of European Russia, wheat is invariably infested by *Haplothrips tritici*, Kurdj., which is especially abundant in years of drought; investigations on the injury caused were carried out in Saratov in the summer of 1938, which was dry. The method used was that adopted by Rubtzov [*cf. R.A.E.*, A **23** 565], the ears being gathered as they were entering the stage of waxy ripeness. The figures showing the weight of the infested and uninfested grains were subjected to the analysis of variance, and the results, which are discussed in detail, showed that in dry summers infestation of wheat at the average rate of 0·5 thrips per grain reduces its weight by almost 5 per cent. When 50 per cent. of the grains were infested, most were attacked by only one or two thrips; not more than 6·8 per cent. harboured five thrips each. Analysis showed that heavily infested grain still contained 28 per cent. gluten and so was suitable for baking.

[Marushev (A. I.) & Grivanov (K. P.).] **Марушев (А. И.) и Гриванов (К. П.). The Effect of the Injuries caused by** *Eurygaster integriceps* **Put. on the baking Properties of Wheat.** [*In Russian.*]—*Social. Grain Fmg* 1938 no. 4 pp. 187–191, 4 refs. Saratov, 1939.

In recent years, the Pentatomid, *Eurygaster integriceps*, Puton, has considerably increased in numbers in certain regions in the south of European Russia, where it is particularly injurious to wheat and also attacks barley and rye. The overwintered adults migrate to wheat from their hibernation quarters and feed on the stems of the young plants, causing the central leaf to turn yellow and wither; later, the ears dry up and turn white. The young nymphs attack the ears and grains. As a result of infestation, the yield and germinating power of the grain and the quality of the flour are considerably reduced. Analysis showed no gluten in wheat flour prepared from grains of which 25 per cent. had been damaged, and loaves baked from this flour did not rise and were not sufficiently porous. The addition of

10 per cent. defective flour to normal flour also considerably reduced the quality of the bread [*cf. R.A.E.*, A **23** 119, etc.]. The usual recommendations of collecting the bugs by hand and destroying the litter in their hibernation quarters are not sufficient to give control, and the author suggests that more satisfactory control might be obtained by means of the parasite, *Telenomus vassilievi*, Mayr, which is able to destroy a large percentage of the eggs [*cf.* **1** 449].

Imamura (S.). **Life-history of** *Zamacra juglansiaria* **Graeser.** [*In Japanese.*]—*Bull. imp. seric. Exp. Sta.* **9** no. 5 pp. 283–293, 1 pl. Tokyo, 1938. (With a Summary in English.)

The larvae of *Zamacra juglansiaria*, Graes., which is widely distributed in Japan, feed on the buds of mulberry in late April and May. This Geometrid has only one generation a year ; the pupae pass the summer, autumn and winter in cocoons attached to the main roots of the food-plant. Near Tokyo, the adults, which live for 8–12 days and are active in the evening, emerge in late March and early April ; the females begin to oviposit 1–2 days after pairing and lay 480–960 eggs in 1–3 days. The eggs are deposited on the upper parts of the branches. The egg stage, the larval feeding period and the process of forming the cocoon each require about 24 days.

Nozu (R.). *Chlorops oryzae* **Mats., a very injurious Pest in cool high Regions.** [*In Japanese.*]—*J. Plant Prot.* **26** no. 6 pp. 399–402. Tokyo, 1939.

The larvae of *Chlorops oryzae*, Mats., which infest the inner parts of the stalks and the ears of rice in Japan, cause serious damage in the mountainous regions of Shimane Prefecture. All stages are briefly described, and notes are given on its bionomics at Okayama [*cf. R.A.E.*, A **25** 225]. The distal parts of the leaves of infested stalks turn greyish-white and then yellow, and wither ; and parts of the ears also become whitish. Control measures comprise burning wild grasses along rice-fields in winter, collecting the adults with nets, and spraying with nicotine sulphate in nurseries. In general, early varieties of rice are more severely injured than late ones.

Kawaai (I.). **On the Results of breeding Experiments with** *Lygus lucorum* **Mey. on Cotton and Egg Plant.** [*In Japanese.*]—*J. Plant Prot.* **26** no. 6 pp. 403–414. Tokyo, 1939.

The experiments described were carried out at Okayama to determine whether a virus disease of cotton and egg-plant [*Solanum melongena*] is transmitted by the Capsid, *Lygus lucorum*, Meyer [*cf. R.A.E.*, A **27** 225]. Adults from diseased egg-plant in the field caused the symptoms on leaves of healthy cotton and egg-plant in 4–5 days. Transmission was effected by transferring even one adult, but in this case, the resulting injury was not severe. Adults from diseased cotton transmitted the disease to healthy cotton in 3–5 days. Near Okayama, the Capsids are present on egg-plant from late June to the end of August and in cotton fields from early July to the end of September. The feeding punctures on the leaves develop into small brown spots, as many as 506 of which were observed on a single leaf. Various Rhynchota of other families that occur in the cotton fields were tested for transmission ; all gave negative results.

TAMURA (I.). **Observations on some Insect Pests of Field Crops.** [*In Japanese.*]—*J. Plant Prot.* **26** no. 6 pp. 414–420. Tokyo, 1939.

The pests recorded on field crops in Ibaragi Prefecture include *Arctia caja*, L., subsp. *phaeosoma*, Btlr., which feeds on wild Composites and also sometimes causes serious damage to wheat, barley and peas, *Chaetocnema cylindrica*, Baly, which feeds on the leaves of dry-land rice in the larval stage from March to June and in the adult stage from July to August, *Pyrausta nubilalis*, Hb., on wheat, *Pagria signata*, Motsch., and *Etiella zinckenella*, Treit., on soy beans, and the mite, *Penthaleus major*, Dug. (*haematopus*, Koch), on wheat in spring.

NOZU (R.). **Diptera as Pests of agricultural Plants, 1.** [*In Japanese.*]—*J. Plant Prot.* **26** no. 7 pp. 482–491. Tokyo, 1939.

All stages are described of *Chloropisca notata*, Mg. (*Chlorops circumdata*, Mg.), which causes serious injury to rye in Japan and also attacks wheat and oats. It has one generation a year and overwinters in the pupal stage in the soil. The adults begin to emerge in late April, and the females oviposit on the leaves. The larvae hatch in 2 or 3 days and become full-fed in about a week. Methods of control include rotation of crops and the cultivation of thin-leaved varieties. Spraying with nicotine sulphate kills the larvae in the leaves, and derris insecticides are also effective.

SUGIMURA (R.). **A new Pest attacking the Root Nodules of Leguminous Plants. (Preliminary Report.)** [*In Japanese.*]—*Agric. & Hort.* **14** no. 4 pp. 1111–1112, 1 fig. Tokyo, 1939.

Descriptions are given of all stages of an unidentified Trypetid that attacks the root nodules of soy beans, cowpeas and other leguminous plants in Japan. Infested nodules usually contain a single larva. The eggs are laid in the soil, and the larvae pupate at a depth of 2–4 ins. The pupal stage lasts 3 weeks, and the adults live for 20–30 days when fed on honey and water.

YUASA (H.). *Rhynchites cupreus* **Linn.?, a new Pest of** *Prunus mume*. [*In Japanese.*]—*Agric. & Hort.* **14** no. 5 pp. 1306–1311, 5 figs. Tokyo, 1939.

A weevil thought to be *Rhynchites cupreus*, L., the egg, larva and adult of which are described, has been a serious pest of *Prunus mume* in recent years in Kanagawa Prefecture. It apparently has one generation a year. The overwintered adults emerge in mid-April and feed on the fruits. They pair in early May, and the eggs are laid singly in wounds made with the rostrum in the fruits, which cause the latter to drop. Infested fruits contained up to 4 larvae. The Reduviid, *Sphedanolestes impressicollis*, Stål, is predacious on the adults. Collecting the adults and infested fruits is recommended for control.

BARNES (H. F.). *Contarinia mali* **n. sp. the Apple Blossom Midge, with Notes on the more common Gall Midges attacking Apple and Pear.**—*Kontyû* **13** no. 3 pp. 126–132, 2 figs. Tokyo, 1939.

Descriptions are given of the adults of both sexes of *Contarinia mali*, sp. n., together with characters distinguishing it from *C. pyrivora*,

Riley. *C. mali* is the Cecidomyiid recorded from apple in Nagano Prefecture in previous papers [*R.A.E.*, A **24** 631, 789]. Its life-history is summarised from these papers; the suggested control measures are hand picking, intensive cultivation in late May and June, and keeping poultry under the trees.

Notes are given on the world distribution, bionomics and in some cases control of six other species of Cecidomyiids that attack apple and pear. None of these has been recorded from Japan, but references are given to various records in the literature of unidentified midges attacking pear in Japan and Korea.

Moriyama (C.). **A Parasite of *Sylepta derogata* Fab.** [*In Japanese.*]—*Bot. & Zool.* **7** no. 6 p. 1124, 1 fig. Tokyo, 1939.

A description is given of the adult of a species of *Eulophus* that parasitises the larvae of *Sylepta derogata*, F., on cotton in Japan. A single host contains 20–40 parasites. The pupal stage lasts a week, and females, which are more numerous than males, live for a fortnight.

Ishikura (S.). **Influence of Temperature and Humidity at the developmental Period upon the Oviposition of *Bruchus chinensis* L.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **11** no. 2 pp. 41–52. Tokyo, 1939.

An account is given of observations on the numbers of eggs deposited at 25°C. [77°F.] and 74 per cent. humidity by females of *Bruchus chinensis*, L., that had been reared at various constant temperatures and humidities on seeds of *Phaseolus radiatus* var. *aureus*. Females reared at 25°C. and 70 per cent. relative humidity laid the greatest numbers of eggs. The numbers were approximately equal in females reared at 20–25·2°C. [68–77·36°F.], but decreased with an increase in temperature above 25·2°C. They increased with an increase in relative humidity, apparently because larval feeding was increased when the humidity was high.

Yokoo (T.) & Morita (T.). **Some Observations on *Oxya velox* Fab. in Korea.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **11** no. 2 pp. 76–80, 2 figs. Tokyo, 1939.

Considerable injury is caused to the ears and stalks of rice in some districts in Korea by *Oxya velox*, F., up to 20 per cent. of the crop being lost in years of outbreaks. The eggs are laid in autumn in masses of 6–50 in soil near the rice-fields and hatch in June. The nymphs moult 5 or 6 times and become adults in late August or September. Outbreaks seem to occur in years of high temperatures and little rain, and other cereals are also attacked. Collecting the egg-masses is the measure adopted for control.

Takahashi (R.). **Life-history and Control Methods of *Pulvinaria polygonata* Ckll. (Coccidae).** [*In Japanese.*]—*Formosan agric. Rev.* **35** no. 6 pp. 403–414, 1 fig. Taihoku, Formosa, 1939. (With a Summary in English.)

Pulvinaria polygonata, Ckll., occurs in sporadic colonies on *Citrus* and *Murraya* in the lowlands of Formosa. The adults, larvae and eggs continue development when transferred from one food-plant to the

other ; no biological races occur, and no males have been observed. This Coccid has 3 generations a year near Taihoku, the adults of which emerge in March and April, from the middle of June and from late August, respectively. The winter is passed in the mature larval stage. The adults, which feed on the branches, become flat and soft when about to oviposit, and crawl upwards, often migrating to the lower surface of the leaves. The egg-mass is formed in 4–5 days and contains about 1,400 eggs. The larvae hatch in 9–13 days, and complete their development in 40–60 days in spring and summer. They feed on the branches and leaves, but those on the leaves develop very slowly and become small adults that do not oviposit. Natural enemies of this Coccid include predacious Coccinellids and the Aphelinid, *Aneristus ceroplastae*, How., which parasitises a large proportion of the larvae. Populations are low from May to late autumn, which is the period of greatest activity of the natural enemies, but larvae that hatch in late autumn escape attacks and give rise to abundant adults in March and April.

Miwa (Y.). **On a Longicorn Beetle injurious to Natalbark** (*Acacia mollissima*) **in Taiwan.** [*In Japanese.*]—*Formosan agric. Rev.* **35** no. 6 pp. 450–454, 1 fig. Taihoku, Formosa, 1939.

Xystrocera globosa, Ol., the adult, larva and pupa of which are briefly described, occurs in small numbers in southern Formosa. This Cerambycid has recently been observed attacking the stems of *Acacia mollissima* ; a popular account of its life-history is given from the literature.

Pruthi (H. S.) & Narayanan (E. S.). **A Statistical Study of the Loss caused by Borers and Termites to Mature Sugar-cane at Pusa in 1935 and 1936.**—*Indian J. agric. Sci.* **9** pt. 1 pp. 15–37, 1 fig., 1 ref. Delhi, 1939.

Work on moth-borers, termites and other pests of sugar-cane in India has dealt mainly with the incidence of these pests and not with the actual loss in weight or sucrose content of infested canes. As these two factors are not necessarily related, investigations on them were carried out at Pusa on a single variety of sugar-cane (Co 331) in 1935 and on 5 commonly grown varieties in randomised plots in 1936. Tables are given showing the percentages of canes infested by the top borer, *Scirpophaga nivella*, F., which was occasionally accompanied by *S. monostigma*, Zell., the stem borers, *Diatraea sticticraspis*, Hmps., *D. venosata*, Wlk., and *Chilo zonellus*, Swinh., the root borer, *Emmalocera depressella*, Swinh., and the termite, *Termes* (*Odontotermes*) *assmuthi*, Hlmgr., both alone and in combination, and the percentage losses in weight due to infestation and the results of chemical analyses of the juice, for all varieties during both years.

The percentages of infestation did not indicate the extent of the damage, and loss in different varieties was not proportional to the incidence of the pest responsible for it. The approximate percentages of canes infested were 60 for Co 299 and 331, 70 for Co 213, and 80 for Co 313 and 210 in 1936, and 78 for Co 331 in 1935. The differences were significant.

The percentage infestation by top-borers, which were the commonest borers on almost all the varieties in both years, averaged 13–24, but

stem-borers, which were least numerous (6–14 per cent. infestation) during both years were responsible for the greatest loss in actual weight and sucrose content in 1935, and for the greatest decrease in sucrose content in Co 331 and 213 in 1936; in that year, however, top-borers caused the greatest loss in weight in all varieties except Co 299, in which the loss was insignificant, and the greatest decrease in sucrose content in Co 313 and 299. In 1935, on the other hand, the percentage loss in weight caused by top-borers was insignificant.

In 1935, canes attacked by *E. depressella* were heavier and contained more sucrose than uninfested ones, but in 1936 the weight of infested canes was less than that of the uninfested ones, and the sucrose content was greater only in Co 331, 313 and 299.

The loss due to *T. assmuthi* was generally insignificant except in Co 210, but so few canes were attacked by it that no reliable conclusions could be drawn.

The total loss in weight due to all the pests combined was significant in all the varieties except Co 299. The order of increasing susceptibility of the other varieties to loss in weight was Co 331, 213, 313 and 210 [*cf. R.A.E.*, A **26** 498] and the varietal differences were significant.

Ramchandra Rao (Y.) & Bhatia (D.). **On the probability of seasonal Migration among the Solitary Phase Individuals of *Locusta migratoria* in North-West India.**—*Indian J. agric. Sci.* **9** pt. 1 pp. 79–107, 1 pl., 1 map, 14 refs. Delhi, 1939.

The establishment of the occurrence of seasonal migrations in the solitary phase of *Schistocerca gregaria*, Forsk. [*cf. R.A.E.*, A **25** 161; **26** 678] led to investigations on this phenomenon in the solitary phases of *Locusta migratoria*, L., and *Patanga succincta*, L., stray examples of which were observed during the periodical surveys carried out since 1931 in north-western India.

P. succincta was encountered mostly in Sind, Rajputana and the Western India States in autumn, winter and spring months, but never during the monsoon period. Although migration in this species appears probable, the available data are not sufficient for a definite conclusion.

The fragmentary data on the distribution of *L. migratoria* from 1931 to 1935 indicate that it is most common in the Sind-Rajputana deserts during the monsoon period, while in Baluchistan it occurs mostly in spring. Fuller details are available for 1936–38. During May–June 1937, intensive breeding was observed in the Kachhi, Bolan and Kohli areas in the interior of Baluchistan, but the population, which in some parts reached a density of over a million per square mile, had disappeared by August. In July, dense concentrations of adults were observed in parts of eastern Bikaner, where heavy breeding occurred in July–August following the abundant rains. The density of the resultant population in August was estimated at 1–3 million hoppers and 2–4 million adults per square mile. The monsoon ceased in July, and in August drought conditions set in. *L. migratoria* gradually disappeared in August and September, apparently migrating with storms travelling south-west from the Bay of Bengal. In September–October, there was a severe hopper infestation in the fields of gramineaceous crops in the Sirohi-Mehsana-Idar areas (S. Rajputana and N. Gujarat). These hoppers are presumed to have been the progeny of adults derived from Bikaner, which on emerging from the hilly tracts of south-eastern Rajputana had selected the nearest wet patches

along the fringes of sandy country for oviposition. The adults appeared in late October, and in early November there was a sudden diminution in their numbers. In November–December, large concentrations of adults were found in fields of *Sorghum* in Kathiawar, Sind and Lasbela ; by March 1938, these had disappeared, but adults were present in irrigated wheat fields in the Kachhi, Bolan and Harnai areas of Upper Baluchistan, where hoppers appeared in May.

This sequence of events can be explained only by assuming that migration on an extensive scale takes place in the solitary phase of *L. migratoria*. Biometrical studies of adults collected in 1937, in which the elytron/femur ratio of 1·90 was provisionally taken to be the upper limit of phase *solitaria*, showed that the proportion of individuals of phase *transiens* to those of phase *solitaria* depended on the degree of concentration at the breeding period. In adults collected in Sirohi in October, phase *gregaria* formed 46 per cent. of the population.

L. migratoria prefers loamy soils for oviposition and graminaceous plants for food. In the desert areas of Sind-Rajputana, females oviposit in clayey hollows among sand-dunes, but since in seasons of good rainfall the desert is covered by a carpet of annuals, the hoppers resulting from such concentrated laying would become dispersed in dense vegetation. In the valleys of upper Baluchistan, arable land is limited to deposits of silt in the valleys between rocky ranges, and there is a possibility of the development of outbreaks due to concentrated breeding and subsequent crowding of hoppers. So far, there are no definite records of swarms of this species in India, though the invasion recorded in Madras in 1878 may have been due to it. As in *S. gregaria*, a development of an outbreak in *L. migratoria* must depend on a combination of suitably situated summer and winter breeding areas, between which seasonal winds could bring regular transferences of locust population. However, a serious outbreak of this species could develop only under exceptional rainfall conditions favouring production of two or more consecutive generations in each breeding area.

Husain (M. A.), Trehan (K. N.) & Verma (P. M.). **Economics of Field-scale Spraying against the White-fly of Cotton** (*Bemisia gossypiperda*, **M. & L.**)—*Indian J. agric. Sci.* **9** pt. 1 pp. 109–126, 1 fig. Delhi, 1939.

In view of the satisfactory results given in small-scale investigations in the Punjab in 1929–32 by sprays applied for the control of *Bemisia gossypiperda*, Misra & Lamba, on cotton, extensive field trials were carried out during 1933–34 in three localities. The results are discussed in detail, and tables show the composition and dilution of the various sprays employed, the percentage mortality of adults and of nymphs and pupae together, the yields per acre from sprayed and unsprayed cotton and the profit per acre which this represents.

In 1933, a spray containing 5 lb. grade III resin, 1 lb. sodium carbonate and 5 gals. water, applied at a dilution of 1 : 6 and one containing 2 lb. resin soap and 1 gal. water (1 : 8), which was tested on only a small area, were equally effective, giving about 80 per cent. mortality, but the former was cheaper. In 1934, these sprays again gave satisfactory results, as did one containing 2 lb. fish-oil soap in 1 gal. water, but the percentage mortalities given by sprays containing a tobacco decoction, a kerosene emulsion or lime-sulphur were low.

The cost of spraying was justified by the increased yield when the applications were correctly timed. A single spray applied in August was effective on American cotton [*cf. R.A.E.*, A **25** 45], but better results were obtained when it was preceded by an earlier one in July. Native cotton should be sprayed in July, as it is injured by spraying in August.

Three types of spraying apparatus were used in the trials, namely two cart sprayers and one in which an engine outside the field forced the spray along pipes laid among the plants. The best results were given by a cart sprayer with 12 adjustable nozzles, which sprayed 4 rows of cotton at a time. Good coverage was obtained with a pressure of 75–130 lb. The types of apparatus are compared under the headings of daily output of work, insect mortality, consumption of insecticide and cost of labour and fuel, and a table gives details under these headings and also shows the total areas sprayed, the costs of insecticide and of spraying per acre, and depreciation charges.

Preliminary dusting trials, carried out during 1933 with calcium cyanide and nicotine sulphate over an area of 10 acres and during 1934 with a number of proprietary dusts over an area of 23 acres, gave unsatisfactory results.

CHERIAN (M. C.) & SUNDARAM (C. V.). **Notes on the Life-history and Habits of** *Dacus brevistylus* **Bezzi (Family Trypetidae), a Pest of** *Coccinia indica* **Fruits.**—*Indian J. agric. Sci.* **9** pt. 1 pp. 127–131, 1 pl., 5 refs. Delhi, 1939.

Descriptions are given of all stages of *Dacus ciliatus*, Lw. (*brevistylus*, Bezzi), which infests the fruits of *Coccinia indica* in Coimbatore, where this crop has not long been introduced, and also those of other cucurbits. The distribution of this Trypetid in the Madras Presidency is indicated, and an account is given of its bionomics, based on observations in 1935.

The pre-oviposition period appeared to last at least 4 days. During the process of oviposition, which is described, as many as 8 eggs were deposited in a hole made in the fruit, often near the stalk; three holes, containing a total of 22 eggs, were observed in a single fruit. Generally one puncture contained 3 or 4 eggs, and when more than 10–12 eggs were deposited in a single fruit, the larvae did not obtain sufficient nourishment, and the pupae and adults to which they gave rise were undersized. The mature larvae dropped to the ground, either in the shrivelled skins of infested fruits, or before these fell. They left the fallen fruits within a day, and entered the soil, in which they pupated at depths varying from ½–2 ins. Adults emerged between 8 and 10 a.m.

An infested fruit can be distinguished by a ridge of brown, dried liquid over the oviposition puncture. After 2 days, a hollow develops at this point and the surrounding tissues become soft and brown; after 4–5 days, the whole fruit becomes discoloured, unless it contains only a few larvae, and falls.

Under laboratory conditions in September and October, when the mean shade temperature was 62·2–89·3°F. and the relative humidity 69·1–78·9 per cent., the egg, larval and pupal stages lasted 2–4, 4 6 and 8–10 days, respectively. The development period lasted 15–17 days, and at Coimbatore there are 6 generations a year. Adults lived for several weeks when fed on honey solution, but for only a few

days when starved. Six individuals of *Opius incisi*, Silv., were bred from infested fruits of *C. indica* collected over a period of 8 months, but as two examples of *Dacus cucurbitae*, Coq., also emerged from the fruits, it was not possible to determine the host of this Braconid.

CALLAN (E. McC.). **Notes on the Woodwasp, *Xiphydria dromedarius*, F., on the Cricket-bat Willow.**—*J. Soc. Brit. Ent.* **1** pt. 9 pp. 242–244, 2 refs. Southampton, 1939.

During a survey of the insects associated with the cricket-bat willow (*Salix alba* var. *coerulea*) in East Anglia, adults of *Xiphydria prolongata*, Geoffr. (*dromedarius*, F.) were frequently observed on or near the trees in several localities in Essex in June–August 1936. They were more commonly found on bright sunny days. Many dead adults were observed partly protruding from holes in the trunks of trees that had been killed by the honey fungus (*Armillaria mellea*) or drought, or by a combination of both ; the rapid drying of the wood associated with attack by this fungus is considered to have prevented their escape from the tunnels in which they pupated [*cf. R.A.E.*, A **21** 639].

During August 1937, 6 females were observed in Suffolk ovipositing in a tree recently killed by *A. mellea*, a few leaves of which were still green although the bark was drying ; none oviposited in a living tree about 5 ft. distant, which was similar in age and size and exposed to the same conditions. Timber is known to be attacked by a definite succession of insects, correlated with its varying moisture and starch contents, at various periods after felling ; in the case of the cricket-bat willow, the first of these is *X. prolongata*.

GOODLIFFE (F. D.). **A joint Infestation of Barley by *Lasiosina cinctipes*, Mg., together with *Chlorops taeniopus* Mg., (Diptera, Chloropidae) and their Hymenopterous Parasites.**—*J. Soc. Brit. Ent.* **1** pt. 9 pp. 248–252. Southampton, 1939.

The examination in 1937 of random samples of spring-sown barley from a small plot in Hampshire showed that 25 per cent. of the shoots had failed to produce normal ears as a result of attack by larvae of *Chlorops taeniopus*, Mg., and *Lasiosina cinctipes*, Mg., the former being 50 per cent. the more numerous. The internodes of shoots infested by *Lasiosina* were shortened, but not swollen, and the ears of some of them were less developed than those of shoots damaged by *Chlorops*, which were evidently attacked at a later stage in their development. In other cases, however, examples of both species were observed in the same shoot. About 50 per cent. of the Chloropid larvae had been parasitised by *Stenomalus micans*, Ol., and less than 16 per cent. by *Coelinius niger*, Nees [*cf. R.A.E.*, A **19** 609]. Evidence is presented indicating that these parasites attacked *Lasiosina* as well as *Chlorops*. The preponderance of *Stenomalus* over *Coelinius* is probably the result of the advantage gained by the former by its earlier maturation ; it pupates before the host larva can do so, whereas *Coelinius* pupates in the host puparium.

DAVIES (W. M.). **Studies on Aphides infesting the Potato Crop. VII. Report on a Survey of the Aphis Population of Potatoes in selected Districts of Scotland (25 July—6 August 1936).**—*Ann. appl. Biol.* **26** no. 1 pp. 116–134, 13 refs. London, 1939.

The results are given in detail of the survey carried out by the author in July–August 1936 on the Aphids infesting potato in 43 centres in

eastern Scotland. The part of the work dealing with *Myzus persicae*, Sulz., has already been noticed from an abridged account [*R.A.E.*, A **26** 709]. Of the other Aphids found, *Macrosiphum solanifolii*, Ashm. (*gei*, auct.) and *Aphis rhamni*, Boy., which have been recorded as vectors of leaf-roll of potatoes in both the United States and Holland, failed to transmit the virus in experiments under glass in Britain [**19** 459]. *M. solanifolii* was taken at 24 centres and was particularly numerous at one of them in the neighbourhood of roses, on which it overwinters in the egg stage. Small numbers of *A. rhamni* were taken at 10 centres. *Macrosiphum solani*, Kalt. (*Myzus pseudosolani*, Theo.), which has been shown to be a vector of potato leaf-roll [*loc. cit.*] and possibly of potato mosaic, was present in small numbers at 12 centres. A table shows the situation of the observation centres, the varieties of potatoes examined and the numbers of the four Aphids taken, usually per 100 leaves.

Subsequent observations on *M. persicae* at two centres near Edinburgh showed that maximum infestation was reached in early September, but this late development of apterous forms would only spread virus infection already existing in the crop.

CALLAN (E. McC.). *Cryptorrhynchus lapathi* **L. in Relation to the Watermark Disease of the Cricket-bat Willow.**—*Ann. appl. Biol.* **26** no. 1 pp. 135–137, 7 refs. London, 1939.

An account is given, mainly from the literature, of the life-history of *Cryptorrhynchus lapathi*, L. [*cf. R.A.E.*, A **4** 69]. This weevil is probably distributed locally throughout Great Britain. Its food-plants include species of alder, poplar, birch and willow, and recent observations suggest that infestation is spreading to the cricket-bat willow (*Salix alba* var. *coerulea*), which is widely grown in parts of East Anglia. The wood of this willow is attacked by a bacterial disease that is probably transmitted by insects, but the weevil, which was suspected of being the vector in Holland [**20** 341], did not transmit the bacterium in experiments in England in 1936–38.

ECKSTEIN (K.). **Die Bewertung des Kotes der Nonnenraupe,** *Psilura monacha* **L. als Grundlage für die Feststellung ihres Auftretens und der zu ergreifenden Massregeln.** [The Evaluation of the Excreta of the Larva of the Nun Moth, *Lymantria monacha*, L., as a Basis for ascertaining its Occurrence and for the requisite Control Measures.]—*Allg. Forst- u. Jagd-Ztg* **114** pt. 8 pp. 132–148, 7 figs., 1938. (Abstr. in *Neuheiten Geb. PflSch.* **32** pt. 1–2 p. 26. Vienna, 1939.)

In this paper the author states that the width of the head capsule is not a reliable guide to the age of larvae of *Lymantria* (*Psilura*) *monacha*, L., on spruce in Germany. Their numbers and age, however, can be estimated from the numbers and size of the lumps of larval excreta, which increase in size with the successive moults, and the coming adult flight can thus be forecast. A larva consumes 30–35 spruce needles daily.

Becker (G.). **Zur Ernährungsphysiologie der Hausbockkäfer-Larven** (*Hylotrupes bajulus* **L.).** [On the Physiology of Nutrition of the Larvae of *H. bajulus*.]—*Naturwiss.* **26** pp. 462–463. Berlin, 1938. (Abstr. in *Neuheiten Geb. PflSch.* **32** pt. 1–2 p. 48. Vienna, 1939.)

The larvae of *Hylotrupes bajulus*, L., develop only in old, dry wood and have no symbionts. Albuminous substances are of great importance in nutrition. Infection of the wood by fungi promotes larval development, which is also furthered by malt solution and, especially, peptone [*cf. R.A.E.*, A **27** 335], but not by soluble starch.

Ambros (W.). **Unsere Waldameise** (*Formica rufa* **L.) mit besonderer Berücksichtigung ihrer künstlichen Vermehrung.** [Our Forest Ant, *F. rufa*, with particular Regard to its artificial Increase.]—*Zbl. ges. Forstwes.* **65** pt. 1 pp. 15–29. Vienna, 1939. (Abstr. in *Neuheiten Geb. PflSch.* **32** pt. 1–2 pp. 49–50. Vienna, 1939.)

For the dissemination of *Formica rufa*, L., which is of value in destroying forest pests [*cf. R.A.E.*, A **23** 8 etc.], the author employs the following method in Czechoslovakia. Nest material with ants in it is lifted by means of a fork from a large colony and placed loosely into sacks of a size large enough to hold 1 cwt. potatoes. Material containing pupae from the interior of the nest is added to each sack. The contents of one sack are used to form a new colony, up to five of which can be established at the same time from a single large, six-year-old colony. The material should not be placed in a depression in the ground, as rain-water may collect there. Half-rotten spruce stumps provide very suitable sites, and if not available should be brought from elsewhere and partly buried at the desired place. If spruce litter is absent, it should be brought and shaken out into a loose heap. The site chosen should be exposed to direct sunlight from 11 to 2 o'clock. Spruce brushwood should be heaped over the new nest in winter and secured to the ground by wire, as a protection against woodpeckers, pheasants and, particularly, badgers, during hibernation. This cover should be removed in spring when the weather becomes warm.

Janisch (E.). **Das klimatische Optimum der Nonnenraupe.** [The Climatic Optimum for the Larva of *Lymantria monacha*, L.]—*Mitt. Forstwirtsch. u. Forstwiss.* **9** pt. 3 pp. 372–386, 13 figs. Hanover, 1938. (Abstr. in *Neuheiten Geb. PflSch.* **32** pt. 1–2 pp. 50–51. Vienna, 1939.)

The temperature at which the duration of development of *Lymantria monacha*, L., shows least variation is always about 21·5°C. [70·7°F.], and this is also the temperature at which the larva is most resistant to disease and poisons. The vital optimum for the larva is at 21·5°C. with 92 per cent. humidity. The optimum can be regarded as fixed and as a physiological specific character.

Noble (N. S.). *Epimegastigmus* (*Megastigmus*) *brevivalvus* **Girault : A Parasite of the Citrus Gall Wasp** (*Eurytoma fellis* **Girault) ; with Notes on several other Species of Hymenopterous Gall Inhabitants.**—*Sci. Bull. Dep. Agric. N.S.W.* no. 65, 46 pp., 18 figs., 27 refs. Sydney, 1938.

An account is given of investigations in northern New South Wales on the Torymid parasites of *Eurytoma fellis*, Gir., which causes the

formation of galls on *Citrus* [*cf. R.A.E.*, A **22** 251 ; **23** 361 ; **25** 47]. In a discussion of the classification of these Torymids, the author quotes from a letter received in 1934 from A. B. Gahan, who considers that *Epimegastigmus* is not even subgenerically distinct from *Megastigmus*, but that *Epibootania* may have subgeneric status. Brief notes are given on various species of *Megastigmus*, several of which have been bred from galls in Australia, but of which little is known. The original descriptions of *M.* (*Epimegastigmus*) *brevivalvus*, Gir., and *M.* (*E.*) *trisulcus*, Gir., which were described from the females, are reproduced, and descriptions are given of all stages, including the adults of both sexes, of *M. brevivalvus* and *M.* (*Epibootania*) *nonvitta*, Gir. [**26** 502], and of the adults and pupa of *M. trisulcus*.

In life-history studies, females of *M. brevivalvus* from galls of *E. fellis* on small *Citrus* trees in pots contained 128–152 eggs. Oviposition sometimes occurred on the day of emergence, the eggs being deposited within host eggs of all ages in the twigs [**23** 361]. In the laboratory, though one egg was usual, up to four were occasionally found in a single host egg, even when unparasitised eggs occurred in the same twig. Host larvae collected in the field usually contained only one parasite larva, and though superparasitism sometimes occurred, host larvae were not observed to contain more than one full-fed parasite larva. The process of development of the egg and larva of the Torymid is briefly described. The larva hatched while the host was in the first instar, and moulted to the second instar during the last instar of the host. It then passed rapidly through the later larval instars, increasing greatly in size, and during its last instar consumed the entire body contents of the host. Parasitised hosts did not pupate. The maximum emergence of adults from the galls took place between mid-October and mid-November, about 2–4 weeks after that of *Eurytoma*. Five adult parasites that emerged from a twig in which unfertilised females had oviposited were all males, while of 5,680 adults collected in the field from 1931 to 1934, 38·06 per cent. were females. Males and females lived for up to 10 and 13 days, respectively, but did not pair readily in tubes or breeding cages in the laboratory. The parasite had one generation a year, the egg, larval and pupal stages lasting 5–6 weeks, about 10 months and 15–28 days, respectively ; its life-cycle is well synchronised with that of the host. *M. trisulcus* was present in small numbers at Grafton in 1932, but in the laboratory no oviposition was obtained when females were enclosed with trees containing eggs and larvae of *Eurytoma*. Gall dissections, however, showed that its pupae were always accompanied by the mandibles and last larval skin of *Eurytoma*. The adults emerged from galls during October and November, a few days later than those of *Eurytoma*, and males and females lived 3–22 and 5–32 days, respectively, in the laboratory, males outnumbering females.

Limited numbers of *M. nonvitta* were present each year in the Grafton district. Cells containing mature larvae or pupae of this species usually contained the remains of mature larvae or pupae of *Eurytoma fellis*, but females did not oviposit when caged with trees containing eggs of *Eurytoma* and *M. brevivalvus*. It is possible that this species is phytophagous in the early larval instars, and attacks only last-instar larvae or pupae of *Eurytoma*. The emergence of the adults was somewhat irregular, occurring sometimes before and sometimes after that of *Eurytoma*. The males survived 4–38 days, and the females, which were less numerous, for 6–42 days.

The percentage of parasitism of *Eurytoma fellis*, based on dissections of the larvae, and the percentages of the different species emerging from galls in 1932–34 are given in tables. Parasitism ranged from 43·87 to 85·29 per cent. and was due chiefly to *M. brevivalvus*.

KNIGHT (Harry H.). *Monalonion* **Herrich-Schaeffer ; Descriptions of Cacao Species from Brazil (Hemiptera, Miridae).**—*Rev. Ent.* **10** fasc. 1 pp. 226–230. Rio de Janeiro, 1939.

Reference is made to the four species of *Monalonion* recorded by Distant from cacao in Colombia [*R.A.E.*, A **5** 457], and descriptions are given of both sexes of *M. bondari*, Costa Lima, and *M. bahiense*, Costa Lima, which were originally described in 1938, and of *M. flavisignatum*, sp. n., all from the State of Bahia, Brazil. These Capsids breed on wild food-plants in the forest, and *M. bondari* and probably the others migrate to cacao and may cause serious injury to the pods [*cf.* next paper].

BONDAR (G.). **Notas entomologicas da Bahia. IV.**—*Rev. Ent.* **10** fasc. 1 pp. 1–14, 3 figs., 5 refs. Rio de Janeiro, 1939.

In this further paper on insect pests in Bahia [*cf. R.A.E.*, A **27** 290], the author quotes the original descriptions of *Monalonion bahiense*, Costa Lima, which is the Capsid previously recorded as *M. xanthophilum*, Wlk. [**17** 159 ; **26** 643], gives characters distinguishing *M. flavisignatum*, Knight, from *M. xanthophilum*, and describes the adults of *M. knighti*, sp. n. *M. bondari* and *M. flavisignatum* migrate from wild food-plants to cacao, of which they attack the pods and shoots, trees that are not shaded being preferred. The wild food-plant of *M. bondari*, which is the commonest species, is unknown, those of *M. knighti*, *M. flavosignatum* and *M. bahiense*, are *Cecropia adenopus*, *Begonia* spp. and *Hamelia patens*, respectively. Females of *M. bondari* and *M. flavisignatum* in nature, and *M. bahiense* and *M. knighti* in the laboratory, oviposited on the green pods and new shoots of cacao. In captivity, females laid 18–40 eggs at the average rate of 4–5 a day, oviposition beginning 3–4 days after pairing and continuing for 5–6 days. The eggs hatched in a few days, and the adults appeared about a month later. The nymphs are fairly active, and with the exception of *M. knighti*, the adults are difficult to catch. As the damage to cacao may cause a crop loss of up to 50–60 per cent., control measures are necessary. Cacao plantations should be shaded and wild food-plants destroyed. A spray of kerosene and soap gives good control, and Bordeaux mixture, which protects the fruits from rot, is also effective.

The adult is described of *Chalcodermus camposi*, sp. n., a weevil that attacks the shoots of cacao in the same way as *C. marshalli*, Bondar [**19** 14], and a list of food-plants of the latter is given.

The chief pest of Anonaceae in Bahia, of which the custard apple, *Anona squamosa*, is the most important, is the Tineid, *Cerconota anonella*, Sepp. Its wild food-plants have hitherto been unknown, but recently the author has observed it attacking the fruits of an anonaceous forest tree. Other pests of fruit-bearing Anonaceae are the Tineid, *Stenoma sciogama*, Meyr., the original description of which, from *A. squamosa* in Bahia, is quoted, the Lamiid, *Alphus canescens*, Bates [**16** 634], the Tingid, *Teleonemia morio*, Stål. [**24** 370],

the Membracid, *Membracis foliata*, L. (*lunata*, F.), the Hispid, *Codiohispa anonicola*, Maulik [**18** 426], and the weevils, *Conotrachelus bondari*, Mshl. [**19** 13] and *Cratosomus bombina*, F. A description is given of the adult of another weevil, *Meroprion anonicola*, sp. n., the larvae of which mine in the leaves of *A. squamosa* and wild Anonaceae. The females oviposit in the mid-ribs, and the adults also feed on the leaves. Collection of infested leaves is the only control measure available.

Curran (C. H.). **African Tachinidae—II.**—*Amer. Mus. Novit.* no. 1022, 5 pp. New York, 1939.

The Tachinids described in this paper include *Sturmia halli*, sp. n., bred from larvae and pupae of *Heliothis armigera*, Hb. (*obsoleta*, F.) and *Rhodesina parasitica*, gen. et sp. n., "parasitic on *B*? *fusca*" [?*Busseola fusca*, Fuller], both in Southern Rhodesia.

Stahel (G.) & Geijskes (D. C.). **Ueber den Bau der Nester von *Atta cephalotes* L. und *Atta sexdens* L. (Hym. Formicidae).** [On the Construction of the Nests of *A. cephalotes* and *A. sexdens*.]—*Rev. Ent.* **10** fasc. 1 pp. 27–78, 21 figs., 26 pls., 10 refs. Rio de Janeiro, 1939.

The leaf-cutting ants, *Atta cephalotes*, L., and *A. sexdens*, L., are very injurious to cultivated plants in Dutch Guiana, and an exact knowledge of the construction of their nests is necessary as a basis for control. Jacoby's method of making cement casts [*R.A.E.*, A **27** 271] was found to have disadvantages, but the authors obtained good results by making plans of vertical sections of the nests. For this purpose, the surface of the ground was divided into six-foot squares of which the sides were marked with lettered and numbered posts. By the side of the nest and along one row of posts, a vertical trench was dug, about 6 ft. wide and 4–5½ ft. deep for *A. cephalotes* and about 12 ft. wide and 10 ft. deep for *A. sexdens*. In line with a row of posts, a side of the nest was laid bare and smoothed so as to show a clear section of the nest cavities. This section was drawn on squared paper, and an 8-in. layer was then removed from the exposed side of the nest to lay bare a new section, until a complete plan of the entire nest was obtained. Detailed descriptions are given of five nests of *A. cephalotes* and one of *A. sexdens* that were investigated in this manner, and their ventilation is discussed. Carbon bisulphide poured into the nest by means of a split bamboo gives good control of *A. cephalotes* in Dutch Guiana, but is less satisfactory against *A. sexdens*.

De Leon (D.). **An Outbreak of a Needleminer, *Epinotia meritana*, in White Fir. (Lepidoptera, Olethreutidae).**—*Pan-Pacif. Ent.* **15** no. 2 pp. 89–90. San Francisco, Calif.; 1939.

A brief account is given of a local outbreak of *Epinotia meritana*, Heinrich, observed in southern Utah in June 1937 on white fir (*Abies concolor*) over an area of 10 acres. Defoliation, which was heaviest on firs of middle age, had evidently been in progress for 4 or 5 years, and many trees were almost dead; the foliage of recently attacked trees was very thin and much of it had a scorched appearance. Both larvae and pupae were present, chiefly in detached needles that hung from the twigs by means of loose webs spun round them by the

larvae. Empty mined needles were held to the twigs in the same way or were lying on the ground. Needles mined by larvae that were apparently in the first instar generally remained attached without a web. Adults emerged from collected material before 8th July. Larvae, probably of the same species, were also common on white fir in a neighbouring National Park during the second half of May and June; larvae and pupae, which occurred in both one- and two-year-old needles, were present as late as 24th June.

This Tortricid was originally described from pine in Utah, and has also been recorded from British Columbia. Descriptions are given of the adult and larva.

Taylor (T. H. C.). **The Usefulness of Entomological Collections in Agricultural Institutions.**—*E. Afr. agric. J.* **4** no. 5 pp. 356–360. Nairobi, 1939.

The author discusses the ways in which the work of economic entomologists is assisted by a collection of authoritatively identified insects, such as that of the Department of Agriculture, Uganda, in connection with which records are kept of the parasites, food-plants, characteristic habits and ecological preferences of the insects, including many species that are not at present of economic importance. He points out the value to agricultural departments of the identification of insects by the Imperial Institute of Entomology in association with the British Museum. Some return for this assistance, which often involves much work in the study of new or little-known species, is received because specimens are retained to enrich the national collections.

Papers noticed by Title only.

Silvestri (F.). **La lotta contro la Mosca delle olive.** [A survey of data on the bionomics and control of *Dacus oleae*, Gmel., on olive in Italy.]—*Atti Convegno naz. Olivicolt. Bari, Settembre 1938* repr. 29 pp., many refs. Rome, 1939.

Russo (G.). **Il fleotribo dell'olivo** (*Phloeotribus scarabaeoides* **Bern.**). [*P. scarabaeoides*, Bern., infesting the Olive in Italy.]—*Circ. Lab. Ent. agrar. Portici* no. 8, 22 pp., 16 figs. Portici, 1939. [*Cf. R.A.E.*, A **27** 473.]

[Sviridenko (P. A.).] **Свириденко (П. А.). Some Materials on the Ecology of Clover Weevils** (*Apion apricans* **Hbst. and** *A. flavipes* **Payk.**) [in the Province of Moscow.] [*In Russian.*]—*Zool. Zh.* **17** no. 3 pp. 509–520, 4 graphs, 12 refs. Moscow, 1938. (With a Summary in English.) [For Summary see *R.A.E.*, A **26** 474.]

Lists of injurious Fungi and Insects intercepted on imported Plants [at Yokohama] **1914–1937.** [*In Japanese.*]—240 pp. Yokohama, Yokohama Customs, 1939.

Eckstein (K.). **Das Bohrmehl der Anobien.** [The Frass and Débris due to Boring by Anobiids.]—*Forstarchiv* **15** pt. 13–14 pp. 268–271, 7 refs. Hanover, 1939.

Immelman (M. N. S.). **On the Control of Temperature and Humidity of Air in small Cabinets.**—*J. ent. Soc. Sth. Afr.* **1** pp. 131–136, 3 figs. Pretoria, 1939.

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Natuurhistorisch Maandblad (Maastricht) : Jaarg. I (1912) : II (1913) Nos. 1–4, 6–9 ; V (1916) Nos. 3–4 ; VII (1918) Nos. 6–9 ; VIII (1919) No. 4.

New Jersey State Department of Agriculture (Trenton, N.J.) : Bulletin 2 ; Circular : 2, 12, 29 (1917–19).

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Ontario Entomological Society Report (Toronto) : 9th (1878).

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